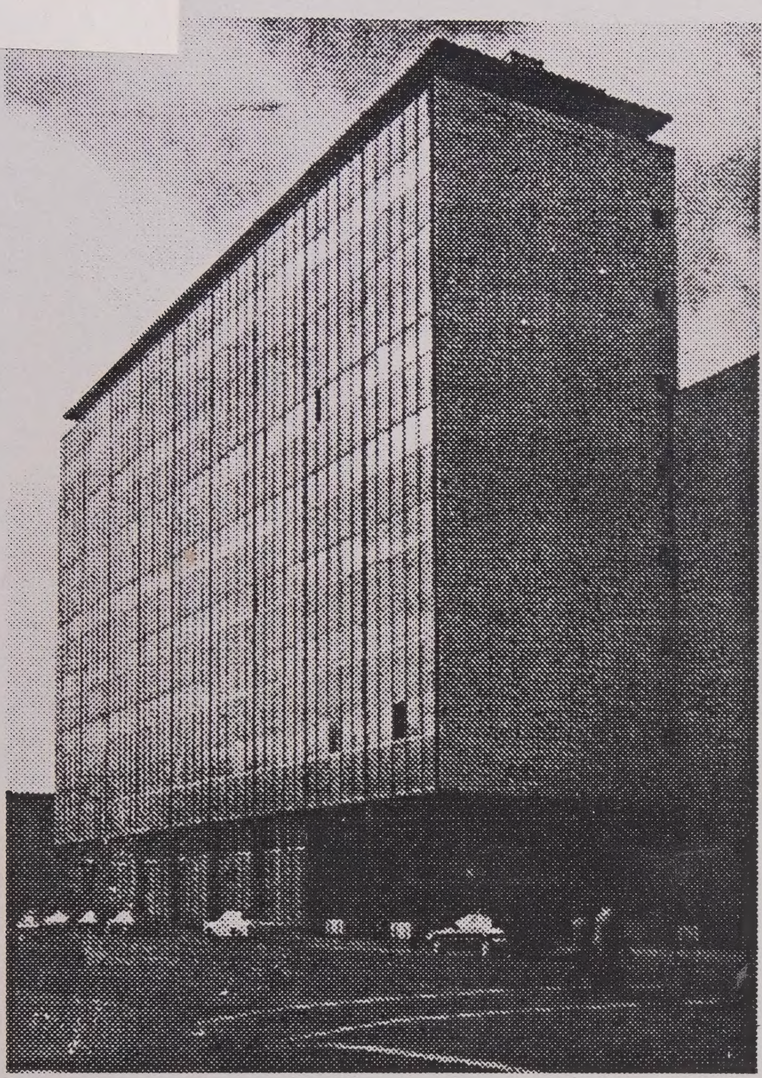


OAKLAND POLICE ADMINISTRATION BUILDING

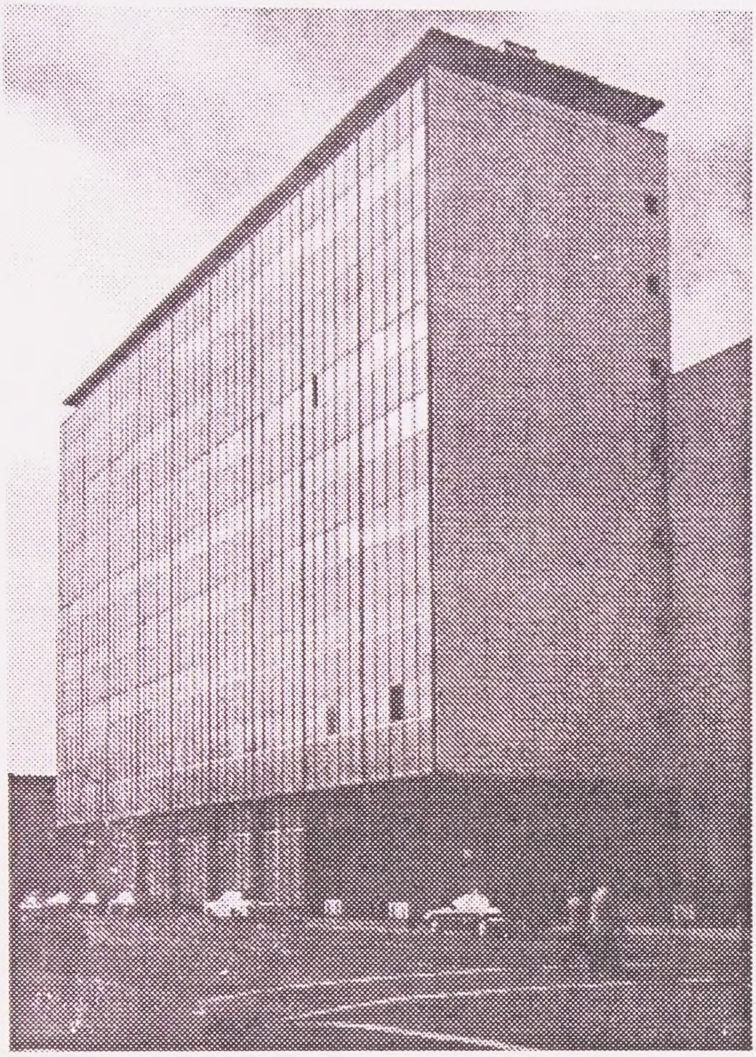
SEISMIC RETROFIT EVALUATION FOR THE "911" FUNCTION

Prepared For
The City Of Oakland
Office of Public Works

August 20, 1993

Prepared By

Paul F. Fratessa Associates
Consulting Structural Engineers
360 22nd Street, Suite 850
Oakland, California 94612



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August 20, 1993

Mr. Horace Gilford
City of Oakland, Architectural Services
1333 Broadway, Suite 850
Oakland, CA 94612

Reference: **Seismic Retrofit Evaluation of the Oakland Police Administation Building for the "911" Function**
Project No.: 316100
Subject: Final Report

Dear Mr. Gilford,

In accordance with your authorization, we have completed the final report for the Seismic Retrofit Evaluation of the Oakland Police Administration Building for the "911" Function. The report and the professional opinions contained therein have been prepared using professional practices currently accepted in the structural engineering profession.

The report has been organized as follows:

- Executive Summary
- Background
- Evaluation Procedures
- Findings
- Recommendations
- References
- Appendix A: Existing Building - Plans and Elevations
- Appendix B: Technical Background Data
- Appendix C: Recommended Retrofit Scheme - Plans, Elevations and Details
- Appendix D: Impact of Retrofit Scheme on Nonstructural Elements
- Appendix E: Estimate of Probable Construction Cost
- Appendix F: Calculations (Bound Separately)

If you have any questions concerning our findings and recommendations, please call.

Sincerely,

Paul F Fratessa (pal)

Paul F. Fratessa, S.E.
President

Enclosures:
Report (5 copies)
Calculations (1 copy)

OAKLAND POLICE ADMINISTRATION BUILDING

SEISMIC RETROFIT EVALUATION FOR THE "911" FUNCTION

AUGUST 20, 1993

Prepared For

The City of Oakland
Office of Public Works

Prepared By:

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EXECUTIVE SUMMARY

PROJECT GOALS

The Seismic Retrofit Evaluation of the Oakland Police Administration Building was originally undertaken to evaluate the building for performance related to housing the "911" function. The "911" function would be either maintained on the 9th floor, relocated to another floor in the building, or relocated out of the building to another site.

The performance criteria established by the City was continuous functionality of the "911" service immediately following an earthquake. Such a performance goal is above and beyond the intent of the Uniform Building Code which was written to ensure life safety (i.e. prevent collapse). Code provisions do not necessarily limit structural damage to a repairable level, nor to a level which would provide continuous functionality and accessibility in post-earthquake conditions.

Project schedule and manhour allocations for the complete study were estimated based on initial investigation of the "911" on the 9th floor, to be followed by evaluations of other locations based on review of the initial findings.

INITIAL FINDINGS

The initial (Phase I) findings were presented in a written report dated January 19, 1993. The initial study revealed that there were identifiable structural weaknesses which indicate that the building would not attain the performance goal set forth as the City's criteria.

After consideration of alternate sites for the "911" function both within and outside the building, the City determined that it was most appropriate to refine the building performance evaluation through an in-depth study and to develop alternative retrofit schemes. This more detailed study became Phase II of the project.

PHASE II EVALUATION

The Phase II study focused on more rigorous structural analyses as well as an expanded definition of the building area requiring post-earthquake functionality. The City determined that the entire Administration Tower and the Jail building should meet the more rigid goals of functionality noted above. The results of this study and the findings of alternative retrofit scheme studies were presented to the City Manager's Office and the City's Office of Architectural Services. The City selected the retrofit scheme upon which this report, Phase III of the project, is based.

Based on the Phase II evaluation, the critical structural weaknesses were identified as:

- Lack of ductility and inadequate strength in columns below discontinuous shear walls in the Administration Tower.
- Inadequate shear and flexural capacity in several shear walls in the Administration Tower and Courthouse Buildings, especially at the main elevator core.

- Inadequate lateral load paths to transfer forces from discontinuous shear walls to adjacent shear walls through the roof/floor slabs.

- Potential blockage of access and egress routes.

The selected retrofit scheme is intended to mitigate the structural weaknesses identified and is summarized as follows:

- Add concrete infill walls below the discontinuous walls in the Tower.

- Strengthen existing concrete walls in the Tower and Courthouse by adding shotcrete and encasing existing column elements at the ends of these walls.

- Strengthen Tower roof by adding new concrete slab dowelled to the existing slab.

- Remove the concrete bents, slabs and braced frame from the Tower roof.

Based on the conceptual retrofit scheme presented in Appendix C of this report, the estimated probable construction cost is $6,000,000. This estimate of construction cost is for seismic retrofit modifications only and does not include other costs often incurred in retrofit projects such as those related to asbestos abatement, Code compliance issues, construction phasing, reprogramming of modified spaces, and tenant relocation costs.

RECOMMENDATIONS FOR FUTURE STUDY

Non-structural elements within the building were found to be subject to potentially high accelerations, especially at the upper floors. It is understood that the City is developing a program (outside the scope of this project) to mitigate nonstructural seismic hazards by bracing (or base-isolating) equipment, furniture, ceilings, access floors, etc. It is recommended that this program include not only the "911" function but also other areas of the building where unbraced nonstructural elements constitute a potential life safety hazard.

Prior to or during the development of Design Development and Construction Documents, additional issues which should be addressed, including those identified above, are:

- Refinement of soils information, including site-specific response spectra

- Bracing of nonstructural elements (architectural features, mechanical eqpt., etc.)

- Non-seismic Code related issues, such as ADA and Fire Marshal mandates

- Construction phasing, tenant relocation, and reprogramming of spaces

- Asbestos abatement

TABLE OF CONTENTS

I. BACKGROUND

I. BACKGROUND

EVALUATION OVERVIEW

This report was developed as Phase III of the Seismic Performance Evaluation of the City of Oakland's Police Administration Building. The project is funded using Measure I funds and is referenced as Project No. 316100.

The evaluation was undertaken to determine the seismic vulnerability of the City's "911" function which is located on the 9th floor of the building. The City has designated the "911" occupancy as an "essential government communication" facility which must remain operational during and immediately after a probable seismic event.

PHASE I

Phase I was intended to establish the basic criteria for acceptable levels of seismic performance and to determine if those levels were met by the existing structure. The level of analysis was limited to fundamental procedures to index the potential performance and to identify major structural vulnerabilities. The Phase I results were summarized in letter report form and submitted to the City on January 19, 1993.

PHASE II

Phase II was intended to refine the findings of Phase I and explore the relative merits of alternative "911" locations based on the vulnerabilities identified in Phase I. The first step involved exploration of alternative locations:

1) Relocation to an alternate site outside the building: Following review of the Phase I findings, the City eliminated consideration of relocating the "911" function outside the building (reference letter dated May 18, 1993 and meeting of May 25, 1993).

2) Relocation to an alternate floor within the building: The comparative site study focused on two alternate locations, specified by the City, at the first and basement floors (reference sketches dated June 9, 1993). However, these locations were eliminated from consideration by the City on June 18, 1993.

The City then requested that the focus of the study be established based on the following parameters:

1) "911" function to remain on the 9th floor.

2) Performance criteria shall be continuous functionality, not only for the "911" function but also for the entire Administration Tower (housing Police operations) and the Jail Building.

3) Potential disruption, overall aesthetic features, and general construction requirements (e.g. access) shall be taken into account in developing alternative strengthening schemes.

Based on these parameters, three alternative retrofit schemes were developed, namely:

A) Add new concrete walls to the north (7th St.) side of the Tower. Eliminate discontinuous shear walls by infilling with new concrete walls, including encasement of existing columns. Strengthen existing Tower walls, including elevator core interior wall, and Courthouse walls by adding shotcrete.

B) Add new steel braced frames to the north (7th St) side of the Tower. Eliminate discontinuous shear walls by infilling with new concrete walls, including encasement of existing columns. Strengthen existing Tower and Courthouse walls by adding shotcrete.

C) Add new concrete walls to the south (6th St.) side of the Tower. Eliminate discontinuous shear walls by infilling with new concrete walls, including encasement of existing columns. Strengthen existing Tower and Courthouse walls by adding shotcrete.

The three schemes are described more fully in Appendix B. The City selected Scheme C and directed the remaining studies be focused on developing this Scheme.

PHASE III

This final report, Phase III, includes the evaluation criteria, methodology, and findings, the conceptual retrofit scheme and associated estimate of probable cost, and recommendations for future study.

PROJECT DATA

Available documents reviewed included partial Architectural drawings (sheets 1 to 39) by Confer and Willis Architects and Structural drawings (sheets S1 to S51) by Isadore Thompson, dated October 30, 1958, and the soils report "Report on Foundation Explorations, Site of Proposed Hall of Justice Building, 7th and Broadway, Oakland, California" by Charles H. Lee, Soil Testing Laboratory, dated July 15, 1958.

LOMA PRIETA EARTHQUAKE PERFORMANCE

No report of structural damage to the building during the 1989 Loma Prieta earthquake was found. The City's Structural Safety Division's 1989 Earthquake file does not contain a Damage Assessment Report (DAR). There were reports of some architectural damage to limited areas of interior partitions and to the expansion joint between the Courthouse and Administration Towers. Minor cracks in the ceramic tile at the west wall of the Tower penthouse were noted during a site walk-through.

BUILDING DESCRIPTION

The Oakland Hall of Justice Complex, located at 455 7th Street, includes the Police Administration Building, the Courthouse Building and the Jail Building as shown in Figure 1. Building data is summarized as follows:

- Site Dimensions (i.e. basement floor): Roughly 200' x 286'.

- Administration Building: 9 stories above street level.
- Courthouse Building: 6 stories above street level.
- Jail Building: 2 stories above street level.

- Typical story height: 14'-6".

- Administration Building and Courthouse Building are separated by 4" expansion joints.

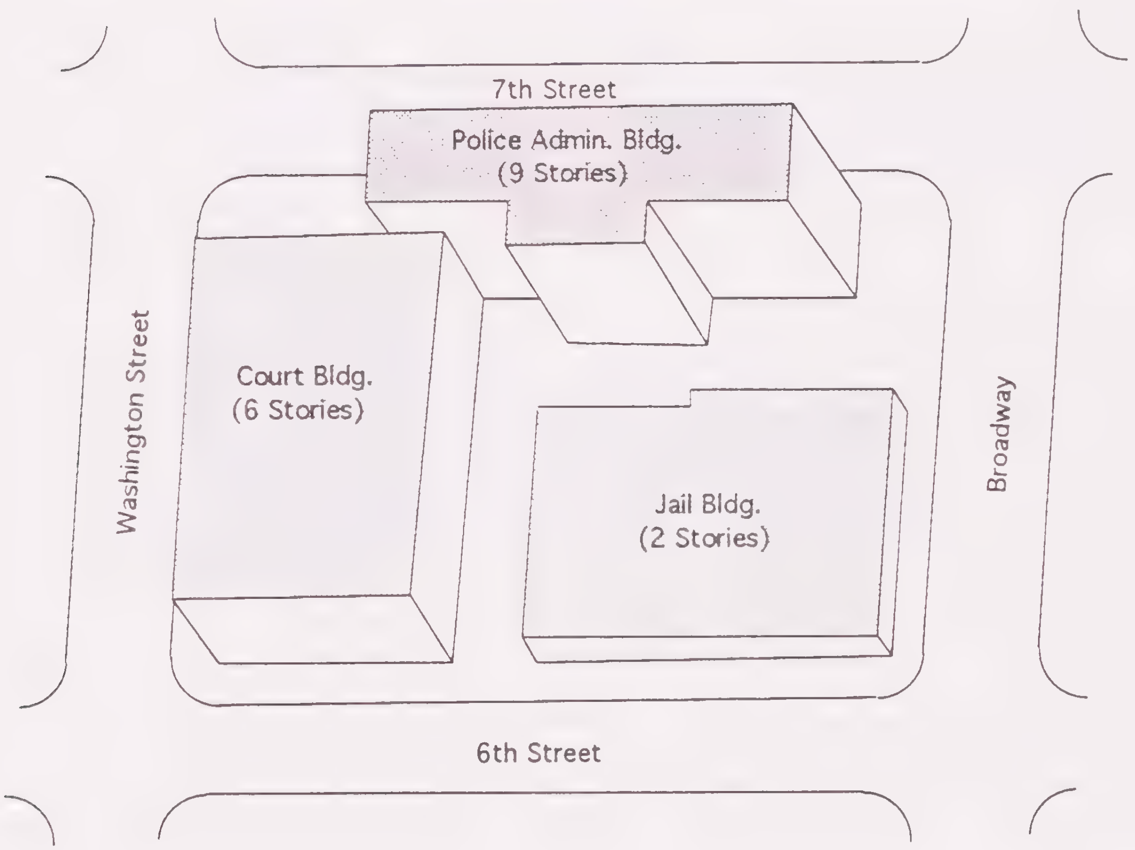

Figure 1: Overall Plan of Oakland Hall of Justice Complex

ORIGINAL CONSTRUCTION

Designed in 1958, prior to modern seismic design standards, the buildings are constructed primarily of lightweight reinforced concrete. The vertical load-carrying system consists of a variety of concrete slab construction - pan-joists, waffle slabs, and flat slabs with drop panels - supported on columns and bearing walls. Design live loads were typically 50 pounds per square foot (psf) in the Tower and Jail, 100 psf in the Courthouse, and 125 psf at parking/ramp areas and in mechanical rooms.

LATERAL LOAD-RESISTING SYSTEM

The lateral load-resisting system consists of load-bearing concrete shear walls and concrete roof and floor slabs acting as horizontal diaphragms (i.e. horizontal structural elements which transfer seismic forces to the the shear walls).

FOUNDATIONS

The foundation system consists of spread footings supporting the columns and walls, a 12 inch thick slab-on-grade, and 12 inch thick basement retaining walls. Based on the original soils report, the site is underlain by roughly 15' of firm to very stiff Merritt Sand, which is underlain by the Alameda Formation, considered generally firm but containing unpredictable soft spots. The design soil bearing pressures were 4800 psf for dead loads and 7000 psf for dead plus live loads, with a 20% increase allowed for perimeter footings.

ATYPICAL CONSTRUCTION

Atypical structural elements include the metal deck on steel framing auditorium roof, concrete block walls at the Tower and Courthouse mechanical penthouses, precast concrete roof panels at the Tower penthouse, and concrete rigid frames and slab on the Tower roof. A pedestrian bridge links the Courthouse Building with the New Jail Building in the next block to the west.

EXTERIOR ARCHITECTURAL FEATURES

Architectural exterior wall finishes include a window wall system on the north (7th Street) side of the Tower, a system of porcelain panels on the south (6th Street) side of the Tower, granite veneer on the east wall of the auditorium, and ceramic tile veneer elsewhere. A two-story lobby entrance area is featured at the street level along the north side of the Tower. A two-story light well occurs between the Courthouse and Jail buildings. A drive-through sallyport area occurs at the street level on the 6th Street side of the Courthouse. Several pieces of HVAC and other equipment, including antenna, occur on the various roof areas of the building.

GENERAL SEISMICITY

The City of Oakland is situated in one of the most seismically active areas in the United States. The San Andreas Fault to the west, the Hayward Fault at the base of the Oakland Hills, and the Calaveras Fault to the east are all recognized as capable of generating a major earthquake. Although the Loma Prieta Earthquake caused considerable damage within the Oakland area, it did not generate ground shaking of the duration or magnitude of what is expected to be produced by an event on the Hayward Fault.

A study group of experts reviewed previous probabilities of earthquakes following the Loma Prieta Earthquake and concluded that the Loma Prieta event did not reduce the odds for a future major event in the Oakland area and that evidence indicates that the probability of a Richter magnitude 7.0 or greater on either the Hayward or San Andreas Fault is greater than previously acknowledged. Current probabilities indicate there is a 67% chance of a magnitude 7.0 event on one of four local fault segments within the next 30 years.

The Hall of Justice Complex is located only 4 miles from the Hayward Fault and roughy 15 miles from the San Andreas Fault - see Figure 2. The site appears to be in a zone of

relatively competent soils generally classified in the UBC for seismic purposes as soil type S2. There is no evidence found in the documentation of materials which will lead to liquefaction, soil failures, or unusual amplification of seismically-induced rock motions.

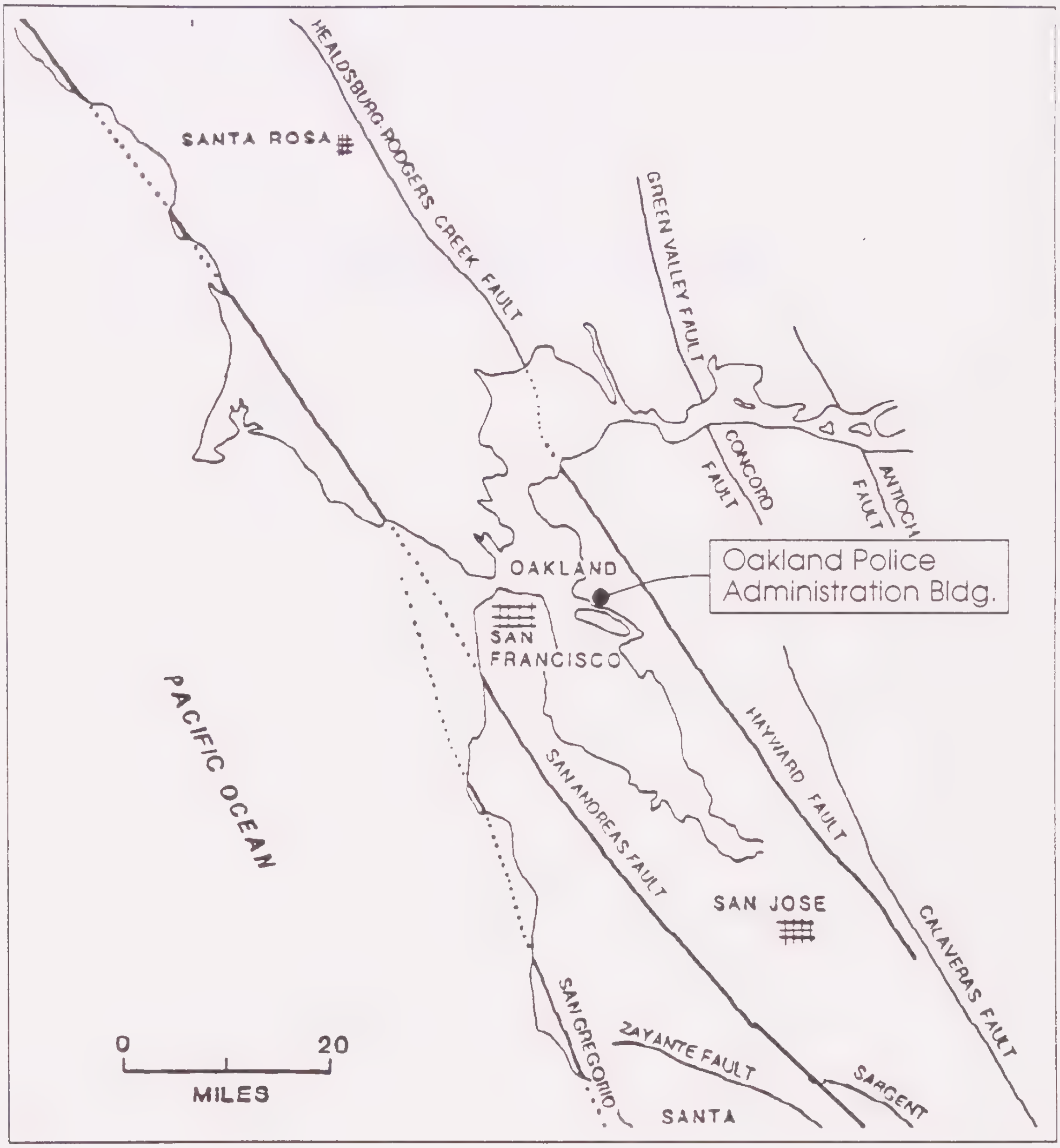

Figure 2: Site Location Map
(Modified from map from the California Governor's Board of Inquiry on the 1989 Loma Prieta Earthquake)

II. EVALUATION PROCEDURES

II. EVALUATION PROCEDURES

PERFORMANCE CRITERIA

The "911" function has been designated by the City of Oakland as an "essential government communication facility". As such, the facility must attain the following performance goals established by the City:

- Continuous functionality immediately after the probable seismic event.
- Immediate access to the critical function areas is ensured.
- Structural and nonstructural damage is repairable.
- Facility will not be "Red Tagged" following the probable earthquake.
- Building collapse is prevented.

Code compliance alone does not necessarily accomplish these goals. The Code (i.e. the Uniform Building Code) represents only minimum requirements for life safety, i.e. building collapse is prevented but major structural and nonstructural damage is accepted. The extent of damage may render the building unoccupiable for a period ranging from days to months. The City has determined that a higher level of performance is mandated for the "911" communications center.

Following review of the Phase I findings, the goal of this study was focused on building modifications required to maintain the "911" facility on the 9th floor. Over the course of the evaluation, the goals and therefore the scope of the study was expanded by the City to include the entire Tower and Jail as areas required to meet the continuous functionality performance goal.

Continuous Functionality Goal

The intent of this goal is to maintain the equipment, utility lines (communications, mechanical and electrical) and work stations required to enable critical communication functions and critical Police activities to remain operational after a seismic event.

Immediate Access Goal

This goal is intended to ensure that the "911" function and critical Police operations remain accessible via unblocked corridors and stairs. Doors leading to these egress routes must remain operational (i.e. cannot be jammed shut). The elevator system was not deemed a critical access link and may be inoperable immediately following the earthquake.

Repairable Damage Goal

The intent of this goal is to preclude major structural damage and to limit damage to levels which can repaired within a "relatively short period" following the earthquake. It should be noted that in the probable seismic event, the building will not be completely free of damage - some wall cracking will occur, even in the retrofitted condition, however, the vertical load-carrying capacity will be maintained. Damage repairs

include but are not limited to: cleanup of debris immediately after the earthquake; repair of damaged partitions, ceilings, furnishings, waterproofing, etc.; repair of elevators, utilities and noncritical equipment; crack repairs in shear walls.

No "Red Tag" Goal

The intent of this goal is to minimize the chance that local authorities would temporarily close the facility following the probable earthquake event. (A general discussion of post-earthquake evaluation of buildings is provided in Appendix B.) By limiting structural damage to attain the goals given above, this objective should be fulfilled. However, it should be noted that the Building Inspector may have other grounds for 'red tagging' a building, including the presence of toxic materials, geotechnical failures, and nonstructural falling hazards; evaluation and mitigation of these hazards is not included in the scope of this project.

Life Safety Goal

The intent of this goal is to minimize the potential for full or partial collapse of the structure. The higher level of performance criteria encompasses and surpasses this goal.

Courthouse Building Criteria

The City designated the Courthouse Building as a nonessential facility, stating that continuous functionality is not required but that it should be occupiable in approximately 30 days following the probable earthquake event. The extent of Courthouse retrofit modifications is based on providing life safety and on the amount of interaction with the Tower and Jail buildings.

DESIGN EARTHQUAKE

As discussed in the General Seismicity section of the Background section of this report, the City of Oakland is located in a region known to be seismically active. The Hall of Justice site is located only 4 miles from the Hayward Fault and roughly 15 miles from the San Andreas Fault. The design earthquake used in the evaluation of the existing structure and design of retrofit modifications is based on an assumed maximum probable earthquake of Richter magnitude 7.0 on the Hayward Fault. For purposes of this study, a maximum credible earthquake described by some as a magnitude 8.3 on the San Andreas fault is assumed to have roughly the same impact on the site as the closer maximum probable Hayward Fault event.

Due to the conceptual level of this study, a site-specific response spectrum was not developed. Based on general geotechnical information regarding soil conditions and response spectra developed for other sites in the vicinity, a design earthquake was developed following the same procedures used in establishing the UBC elastic response spectrum. However, it is anticipated that the building will not perform elastically for the higher level of performance postulated. Therefore, the pseudo-inelastic building performance was evaluated using a response spectrum which acknowledges the more realistic nonlinear behavior.

A more detailed discussion of the design earthquake used is provided in Appendix B.

METHODOLOGY

INITIAL STUDIES

The Phase I preliminary evaluation focused on the "911" function in the Tower, using equivalent static lateral force procedures and Code level forces. The preliminary evaluation identified discontinuous shear walls and columns supporting them as the critical structural weaknesses. It also indicated high shears and overturning forces in the end walls and in the elevator/stair core of the Tower. The weaknesses could lead to partial collapse of structural elements and blockage of access to the "911" function.

The structural system of the building complex is highly irregular, both vertically and in plan. More rigorous analyses were deemed necessary to provide a better assessment of the actual behavior. These analyses, along with development of retrofit schemes, were performed as Phase II of the project.

PHASE II EVALUATION

The more detailed analyses of the existing building performed in the Phase II evaluation included:

- Parametric two-dimensional studies of a typical floor of the Tower:

  These studies evaluated the effects of the large openings on the distribution of seismic forces through the floor slab. These openings occur at the elevator shafts, stair well and mechanical shaft. A discussion of the two-dimensional models and parameters studied is provided in Appendix B.

- Three-dimensional response spectrum analysis of the existing building:

  A three-dimensional computer model of the entire building was created and subjected to the design earthquake response spectrum. The overall building performance was evaluated and an assessment of member forces with respect to member capacities was made. A detailed discussion of the modelling assumptions is provided in Appendix B.

- Three-dimensional analysis of inelastic behavior of the existing building:

  The three-dimensional computer model was revised to simulate cracked wall conditions and a response spectrum analysis was executed to estimate an "upper bound" of the building's inelastic response. This analysis roughly indicates the building behavior once the walls have "softened" due to significant cracking. A discussion of this analysis is provided in Appendix B.

- Three-dimensional analyses of isolated portions of the existing building:

  In order to develop a fuller understanding of the effects of the multi-tower configuration and irregular mass distribution, separate three-dimensional models of the Tower-only and the base-only were created and subjected to the same response spectrum analysis. See Appendix B for a more detailed discussion.

- Comparison to UBC Equivalent Lateral Static Approach:

  The UBC Equivalent Lateral Static Approach was applied to the entire building for purposes of comparing the simplified Code minimum results with the more realistic dynamic response spectrum results. See Appendix B for a more detailed discussion of findings.

Based on the results of the above analyses, structural vulnerabilities were identified. Retrofit modifications were proposed to mitigate these vulnerabilities and were evaluated by adjusting the three-dimensional computer model and rerunning the response spectrum analyses. Development of the retrofit schemes involved several iterations of analyses to attain solutions which meet the performance goals estabiished.

INDICES OF ACCEPTABLE STRUCTURAL DAMAGE

Performance indices are engineering parameters from which qualitative judgments about relative seismic performance can be made. For this study, these indices include Inelastic Demand/Capacity Ratios and Interstory Drifts, described as follows:

- Inelastic Demand/Capacity Ratios:

  The design earthquake analyses yield shear, flexural and axial forces in structural members such as shear walls, columns and slabs. These postulated forces are termed Demand forces. Since the design earthquake represents an "ultimate" or unreduced spectral level of loading, the Demand forces are not multiplied by a "load-factor" normally applied under Code-minimum analyses.

  The member Capacities are computed based on theoretical elastic strengths associated with given material properties and amounts of reinforcing steel as indicated on the as-built drawings. The Capacities are intended to represent "ultimate" member strengths and therefore are not multiplied by the reduction factor (ø) normally applied under Code-minimum evaluations.

  The Demand forces are compared to the member Capacities in the form of Inelastic Demand/Capacity ratios. The term Inelastic is used to indicate that some amount of post-yield strength is acknowledged in evaluating the ratios.

- Interstory Drifts:

  The relative displacement of one story with respect to the next story below is termed Interstory Drift. Interstory Drifts can indicate damage to both structural and nonstructural elements.

For purposes of this study, limiting values for the indices described above have been established based on review of research studies, discussions with researchers and practicing structural engineers, and engineering judgment. These limiting values set the assumed upper limit of acceptable damage and are presented as follows:

- *Inelastic Demand/Capacity Ratios for the Tower and Jail Buildings*:

  Shear: 1.25

  Flexure: 2.0

  Axial (in columns): Elastic buckling capacity

- *Inelastic Demand/Capacity Ratios for the Courthouse Building*:

  Shear: 1.5

  Flexure 2.5

  Axial (in columns): Elastic buckling capacity

- *Interstory Drift*:

  Maximum: 0.003h (where h is the story height)

III. FINDINGS

III. FINDINGS OF EXISTING BUILDING EVALUATION

SUMMARY OF THE PHASE I EVALUATION

The Oakland Police Building is structurally classified by Code as highly irregular, both in plan and vertically. These irregularities include: a) weight (mass) irregularity, b) vertical geometric irregularity, c) in-plane discontinuity of shear walls, d) torsional irregularity, e) reentrant corners, f) diaphragm discontinuities, and g) out-of-plane offsets of shear walls. In general, buildings which exhibit such irregularities, especially those with discontinuous shear walls leading to discontinuous load paths, have performed poorly in past earthquakes.

The Phase I evaluation identified the discontinuous shear walls on Lines 5 and 19 (see Figure 3) as critical structural weaknesses. Discontinuous shear walls are generally undesirable since they involve an abrupt change in the lateral load path. Often, such as in the Police Building, the absence of walls below results in a discontinuous lateral load path if the seismic forces in the wall cannot be transferred to adjacent structural elements. Columns supporting these walls lack ductile detailing features such as closely-spaced ties and 135-degree hooks, therefore, these columns will likely respond in a brittle manner under the high axial forces created by the overturning forces from the discontinuous shear wall above.

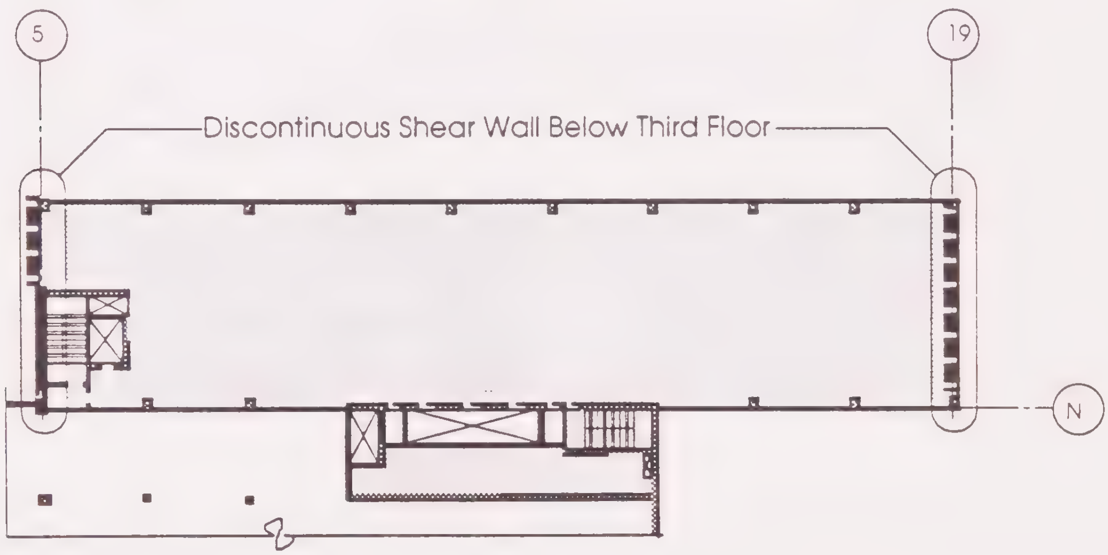

Figure 3: Discontinuous Shear Wall Below Third Floor

The Phase I evaluation also identified the elevator wall on Line N as a critical structural weakness. This wall contains several door and duct openings which reduce the net wall section available to transfer seismic shears. Due to the large slab openings at the elevator and stair shafts, this wall serves as *the* shear wall for the main Tower area for seismic loads in the east-west direction, i.e. there is minimal redundancy in the lateral-load resisting system in this direction. There are two minor walls at the west stair however, only a limited amount of load can be transferred to them, due to slab (diaphragm) openings and limited collector elements.

In the event of <u>major</u> ground shaking, damage to these structural elements could lead to partial collapse and thus constitute a life safety hazard. The damaged shear walls could create access blockage at the stair wells, an unacceptable scenario for the "911" function on the 9th floor.

PHASE II EVALUATION

Based on the Phase I evaluation, a more rigorous analysis to assess actual demand forces and to account for inelastic behavior was deemed appropriate. As described in Section II, this assessment consisted of two-dimensional parametric studies of a typical tower floor slab and three-dimensional dynamic analyses of the entire building complex. The findings of these studies are summarized below.

Two-Dimensional Studies of Typical Tower Floor Slab

Two-dimensional computer models of a typical Tower floor slab were used to evaluate the effects of the large openings at the elevator/stair core. The studies showed that these openings significantly affected the distribution of shears through the floor slab. Based on the results of these studies, it was concluded that the Tower area should be treated as two separate towers when developing the three-dimensional model of the building. A more detailed discussion of these studies is provided in Appendix B.

Three-Dimensional Analysis of Existing Building - Global Dynamic Response

Using the methodology described in Section II of this report, a three-dimensional model of the building's lateral load resisting system was created and subjected to the design earthquake response spectrum. The analyses confirmed the structural weaknesses of the Tower identified in the Phase I evaluation and also provided additional insight into the building behavior. These findings are discussed in more detail in Appendix B and are briefly highlighted below:

- The elastic first mode period of the building is approximately 0.53 seconds.
- The eccentric layout of the walls and masses creates significant torsional forces.
- The irregular mass distribution significantly affects the accelerations in the Tower.
- The maximum spectral acceleration at the Tower roof is 1.51g.
- The maximum spectral interstory drift is 0.0043h.

Using demand forces obtained from the three-dimensional analyses, the structural members were evaluated. The results of these evaluations are presented below.

Shear Walls

The concrete shear walls are 10" thick, typically, and 12" thick in the basement, typically. A few 8" thick walls occur at some stairwells. The walls are constructed of lightweight concrete with a design compressive strength of 3750 psi, and reinforced with 40,000 psi steel, typically #3 @ 9' on center, each face, horizontally, and #4 @ 16" on center, each face, vertically.

The earthquake demand shear forces from the 3D response spectrum dynamic analysis have been summarized for each wall for each floor and represent ultimate demand loads. Similarly, the shear capacities have been summarized for each wall for each floor; the shear capacities were derived without the strength reduction factor "ø". The ratio of the demand force to the capacity, termed the inelastic demand/capacity ratio (DCR),

was then tabulated for each wall for each floor, and is presented in tabular form in Appendix F. Those DCR's greater than 1.0 are shown on the floor plans in Appendix F (calculations). An example of such a floor plan is provided as Figure B-5.

As described in the Performance Criteria in Section II of this report, DCR's up to about 1.25 are generally considered to represent an acceptable level of damage for shear in concrete walls for essential facilities. For the Courthouse area, designated as a nonessential facility, a higher amount of damage is acceptable, therefore, DCR's up to 1.5 were typically considered to represent acceptable states of stress.

The shears in the elevator core wall (on Line N) were further distributed via relative rigidities to the segments of wall (i.e. piers) between the door openings. Demand/capacity ratios were computed for shear and flexure in the piers and were generally within the acceptable limits stated above.

Columns

The concrete columns are typically constructed of lightweight concrete with design compressive strength of 5000 psi, and reinforced with 40,000 psi steel deformed bars. The column longitudinal (primary) reinforcing consists typically of #11 bars in the Tower and varies from #11 to #6 bars elsewhere. The column ties (transverse reinforcing) are typically #3 at 18" on center, substantially less than required by current Codes to provide adequate confinement under high compressive loads. Also, the column ties have 90 degree hooks at their ends rather than 135 degree as required by current Codes. In past earthquakes, the 90 degree hooks have opened up which resulted in extensive deterioration and even partial collapse of the concrete column. The lack of such ductile detailing will likely lead to significant damage and possibly partial collapse, especially at those columns supporting the discontinuous walls in the Tower.

The columns below the discontinuous shear walls at the ends of the Tower building, e.g. at grid lines P/19 and N/19, were found to have excessive axial stresses due primarily to the overturning forces from the seven-story wall above. Column interaction diagrams were developed for the columns supporting the discontinuous walls, i.e. for columns at the intersections of gridlines P/5, P/19, N/19, M/9 and M/15. The interaction diagrams show the elastic capacities of the column for various combinations of axial and flexural loads, for a specified amount and arrangement of reinforcing steel. The estimated axial/flexural demand loads are plotted to determine their relationship to the column's capacity - points outside the curve indicate an overstressed condition in the column. Figure B-6 shows the interaction diagram for the column below the 2nd floor at P/19.

The concrete cover over the longitudinal (primary) reinforcing is shown on the drawings as 1.5" and 2" at interior and exterior faces, respectively, and conforms with current Code requirements.

Concrete Slabs

The concrete slabs are constructed of lightweight concrete with design compressive strength of 3750 psi and reinforced with 40,000 psi steel. The slabs act as horizontal diaphragms, structural elements which distribute the seismic forces to the shear walls.

In the Tower, the roof and floors consist of a system of pan-joists with 10" deep ribs at roughly 3' on center supporting a 4" thick slab; the pan-joists span between girders and end walls spaced 20' on center. The shear demand forces were compared to the

capacities of the slab and of the slab to wall transfer are were found to be excessive at the Tower roof but within acceptable ratios at the floors below. Also, the roof slab's chord and collector members were deemed inadequate for the postulated seismic forces. However, at the lower three floors, there is a lack of collector steel to transfer the seismic forces to the slab where the Tower walls are connected to the remainder of the building.

The 5' and 8'-9" wide slab sections between the north and south Tower areas were found to have excessive demand/capacity ratios for shear and flexure under east-west seismic loading.

In the Courthouse, the roof and floors consist of a waffle-slab system with 10" deep ribs at roughly 3' on center, each way, supporting a 4" thick slab; solid 14" thick slab areas occur around interior and exterior columns. The shear capacities were compared to the seismic shear demands and found to be within acceptable limits.

In the Jail, the roof and floors consist of typically of 10.5" flat slabs with 15.5" drop panels around the interior columns. The slab's shear capacities were deemed adequate for the demand forces being transferred to the perimeter shear walls.

Concrete Masonry Unit Walls

8" concrete masonry unit (c.m.u., or concrete block) walls occur on three sides of the Tower penthouse over the main elevator/stair core. These walls act as shear walls, supporting the loads from the precast concrete penthouse roof slab panels which are dowelled to the c.m.u. walls with #3 at 48" on center.. The walls are reinforced with 2-#5 at 48" on center, vertically, and #4 at 48" on center, horizontally; the walls continue 2'-6" above the penthouse roof, acting as cantilevered parapets. It appears only those cells containing reinforcing steel are grouted. The 8" c.m.u. walls appear capable of withstanding out-of-plane forces up to roughly 0.6g, substantially less than the predicted 1.5g at the Tower roof .

Similarly, the west penthouse on the Tower roof has 8" c.m.u. non-bearing infill walls on three sides. These walls are reinforced with #5 at 32" on center, vertically, and 2-#3 at 24" on center, horizontally, and are nominally attached to the reinforced concrete structure via 5/8" diameter bars at 64" on center. These 8" walls appear capable of withstanding out-of-plane forces up to roughly 0.65g.

Similarly, two sides of the penthouse on the Courthouse roof and some of the mechanical shaft openings have 6" c.m.u. non-bearing infill walls, reinforced with #4 at 32" on center, vertically, and 8 gage wires at 16" on center, horizontally. Assuming 6' vertical spans at the Courthouse penthouse and 7' horizontal spans at the mechanical shafts, it appears the 6" c.m.u. walls are adequately reinforced for the postulated out-of-plane seismic forces.

Foundations

Based on the original soils report, the design soil bearing pressures are 4800 psf for dead loads and 7000 psf for dead plus live loads, with a 20% increase allowed for perimeter footings. A factor of two was assumed for ultimate allowable soil pressures for dead plus live plus seismic loads.

The spread footings under the columns vary in thickness from 24" to 42" and in plan from 3'-8" square to 16'-6" square. The continuous spread footings under the shear walls vary in thickness from 9.5" to 24" and in width from 18" to 90". The soil bearing pressures at the spread footings under some of the shear walls and column supporting the discontinuous shear walls in the Tower were found to exceed the assumed ultimate allowable pressures by as much as 1.7 times.

A coefficient of friction of 0.4 was assumed for the interface between the bottom of the foundations and the soil. The seismic base shear coefficient was computed as 0.41g, or 5% greater than the coefficient of friction. Assuming the 12" thick slab-on-grade can act as a horizontal diaphragm in distributing the seismic shears and in combination with the passive pressure acting against the vertical faces of the footings and against the basement walls, the building's sliding resistance was deemed adequate for the demand forces.

A very rough estimate of the effects of rocking was made by derived by applying a range of assumed soil stiffnesses, modelled as springs, under the columns of the shear wall at the east end of the Tower (on Line 19). The 2D analyses indicated that a reduction in story forces and accelerations would occur if the deformations of the soil under the spread footings were significant.

Miscellaneous

The concrete rigid bents on the roof were evaluated for the high seismic roof accelerations and were found to lack adequate shear and flexural reinforcing in both the beam and column elements of the bents. Also, the bents lack adequate dowels attaching them to the roof structure. The concrete X-braced frame on the roof similarly lacks adequate tensile capacity in the diagonal members and is also only nominally attached to the Tower roof slab.

The 3'-6" high reinforced concrete parapets around the perimeter of the Tower roof are 6" wide and cantilever from the roof structure. The parapets were analyzed for out-of-plane loads based on the seismic roof accelerations and were deemed adequate in shear and flexure.

The 8" thick reinforced concrete wall at the east side of the auditorium acts as a bearing and a shear wall, supporting the loads from the metal deck and steel-framed auditorium roof. The walls were evaluated for seismic out-of-plane forces based on 0.53g, corresponding to the estimated 3rd floor acceleration, and were deemed adequately reinforced to span vertically two-stories.

During a site walk-through, a large cooling tower was noted on the roof area located between the Tower and Jail buildings. The cooling tower sits approximately 4' above the roof on steel beams supported on top of concrete columns. The structural drawings do not indicate these columns as continuing from below and no other system of lateral load bracing was visually observed.

Three-Dimensional Analysis of the Building's Inelastic Behavior

A response spectrum analysis of the building assuming post-yield conditions was performed and is described more fully in Appendix B. The results of this analysis indicated that the inelastic behavior of the building leads to lower forces and accelerations but

yields higher story displacements. These higher displacements indicate pounding between the Tower and Courthouse building is likely to occur.

Comparison to UBC Equivalent Lateral Static Approach

For purposes of comparison only, the UBC provisions were applied to determine the building period, base shear and distribution of forces over the height of the building. A detailed discussion of the results is provided in Appendix B. In brief, the results indicate that the simplified empirical Code formulas do not predict the realistic response of the Hall of Justice Complex.

IV. RECOMMENDATIONS

IV. RECOMMENDATIONS

DEVELOPMENT OF RETROFIT SCHEMES

Once the performance criteria had been established and the decision made to maintain the "911" function on the 9th floor, several alternative retrofit schemes were explored, employing various combinations of cast-in-place concrete, pneumatically-placed concrete (termed "shotcrete") and steel braced frames. To minimize disruption of interior spaces and for ease of construction, the structural strengthening elements were located at the exterior walls of the building as much as possible. The three alternative schemes presented to the City are shown for a typical Tower floor in Figures B-7, B-8 and B-9 and are briefly described as:

A) Add new shotcrete to the existing end walls and elevator core walls; add new concrete walls below the discontinuous shear walls, including encasement of existing columns; add new concrete walls to the north (7th St.) side of the Tower.

B) Add new shotcrete to the existing north-south end walls and elevator core walls; add new concrete walls below the discontinuous shear walls, including encasement of existing columns; add new steel braced frames to the north (7th St.) side of the Tower.

C) Add new shotcrete to the existing north-south end walls and elevator core walls; add new concrete walls below the discontinuous shear walls and to the south (6th St.) side of the Tower, including encasement of existing columns.

All three schemes include the addition of new shotcrete to portions of the east and west Courthouse walls. Strengthening of the walls in the Jail area is not required.

The City selected scheme C as the preferred scheme because schemes A and B involve undesirable drastic changes to the building's appearance and the obstruction or deletion of several premium window offices. Also, schemes A and B involve shotcreting the interior elevator wall which would cause major disruption to the Police operations since the only access between floors would be through the west stair. The City acknowledged that scheme C would be more disruptive to interior spaces, and possibly more costly, but felt that maintaining the existing window wall on the 7th St. side is a justifiable tradeoff.

Retrofit using base isolation was not judged to be cost effective based on the building configuration (e.g. tall shear walls yield high uplift forces; lack of ductile detailing would still be a problem; difficulty in providing a seismic gap and flexible connections (for water, sewage, gas and electricity) completely around the building; difficulty in providing a seismic gap around certain basement locations (e.g. main mechanical room) which extend to varying depths below the basement slab-on-grade which currently exists typically three feet below the water table per the original soils report). Base isolation is often considered when preservation of the exterior finishes is an important goal, such as for historic buildings; the Oakland Police Building was not specified as such a building. No formal studies were performed to confirm the above appraisals.

RECOMMENDED RETROFIT SCHEME

The recommended retrofit scheme is summarized as follows:

1) Add new concrete infill walls below the discontinuous shear walls on Lines 5, 9, 15 and 19 - see Figures C-5, C-6 and C-7. The new infill walls will require new continuous spread footing foundations.

2) Strengthen existing north-south walls on Lines 5, 9, 15, 19 in the Tower by adding new shotcrete (i.e. concrete pneumatically projected at high velocity onto a surface) - see Figures C-3 to C-7, C-9 and C-12. Incorporated in the shotcreted shear wall are beam and column elements which provide confinement around the wall elements and which form ductile frames which ensure vertical load-carrying support even under cracked wall conditions.

3) Encase the existing concrete columns at the ends of the shear walls to provide adequate confinement - see Figures C-14, C-15, C-16 and C-18.

4) Add new concrete walls at the south (6th Street) side of the Tower to stiffen and strengthen the building in the east-west direction - see Figures C-3 to C-7, C-8 and C-13. These walls can be either formed and cast-in-place or shotcreted. The thickness of the new walls was estimated assuming some amount of window and /or door openings would be required for functionality. Also, similar to the north-south direction, vertical load-carrying ductile frames are incorporated into the new shear walls.

5) Strengthen the existing north-south walls on Lines 1 and 6 of the Courthouse by adding new shotcrete - see Figures C-10, C-11, and C-19. Some window openings will be infilled to stiffen the exterior walls enough to reduce the stresses in the interior walls. Due the critical openings required at the first floor (in the sallyport area) and at the basement, the discontinuous wall condition on Line 6 could not be eliminated, however, the existing columns at the ends of the shear walls above will be encased in concrete to provide the required confinement and strength.

6) Strengthen the Tower roof diaphragm by adding new concrete dowelled to the existing slab - see Figure C-2. The existing non-structural items on the roof, including equipment and drainage topping, need to be removed and replaced to accomplish the slab strengthening.

7) Remove the concrete rigid bents, X-braced frame and slabs from the roof - see Figure C-1.

THREE-DIMENSIONAL ANALYSIS OF RETROFITTED STRUCTURE

Using the methodology described in Section III of this report, the three-dimensional model was adjusted to correspond to the recommended retrofit scheme and dynamic analyses were performed using the same design earthquake applied to the original building. The resulting global response determined from these analyses are discussed more fully in Appendix B are are briefly highlighted below:

- The elastic first mode period of the building is computed to be 0.39 seconds.
- The maximum spectral acceleration at the Tower roof is 1.59g.
- The maximum spectral interstory drift is 0.0022h.

IMPACT OF RETROFIT SCHEME ON NONSTRUCTURAL ELEMENTS

The seismic retrofit scheme was evaluated for impact on the building's non-structural elements, such as architectural features and overall mechanical/electrical systems. The findings of the general survey are provided in Section V of this report.

ESTIMATE OF PROBABLE CONSTRUCTION COST

The estimate of probable cost for only the structural retrofit modifications and repair of non-structural items impacted by the structural work is $5,973,000. For purposes of budgeting, this value is rounded to $6,000,000 so as not to reflect an inappropriate level of accuracy. Revisions and/or improvements to mechanical/electrical systems and architectural features, including reprogramming of spaces, is not included in the project scope, therefore, costs associated with these items are not included. A detailed breakdown of the cost estimate along with a listing of assumptions and notes is provided in Appendix E of this report. The estimate includes factors of 17% for general conditions, overhead and profit, 20% for design contingency and 4% for escalation to mid-point of construction, assuming a 1994 start of construction.

As discussed with the City, the estimate was developed assuming standard construction conditions such as complete and uninterrupted access to the building, i.e. it does not include costs associated with such constraints as phasing, protecion for people working in the building, nor provision of temporary mechanical/electrical systems for continuous operation of building during construction. Depending on the available space within the building and/or nearby buildings, amount of relocation and phasing will increase the estimated cost by 10 to 50%. The estimate does not included the costs associated with reprogramming of spaces nor addressing Code-related issues which may be mandated or triggered by the Fire Marshall, Building Department, ADA, etc.

Also per the City's direction, the estimate does not include the costs associated with the anchorage/bracing of non-structural items, including the "911" equipment. It is understood the City will evaluate such anchorage/bracing separately from this project.

RECOMMENDATIONS FOR FUTURE STUDY

The retrofit scheme presented above is a conceptual scheme only, developed to meet the established performance goals for the "911" function and with sensitivity to the user's needs/preferences and cost effectiveness. The structural strengthening solution was derived by applying traditional analytical procedures for buildings consistent with the standard of care of the profession. Prior to the development of construction documents, the City may want to consider the application of even more rigorous analyses, such as non-linear time-history analysis, soil-structure interaction (rocking), etc. The general retrofit concept will remain the same but there may possibly be some reduction in new concrete thicknesses, roof and floor accelerations, and foundation bearing pressures.

The following items were not included in the project scope and are recommended for future study prior to the development of construction documents:

1) Obtain site specific geotechnical information and recommendations, including ultimate soil bearing pressures and coefficient of friction, site-specific response spectrum, seismic increment of soil pressure on the retaining walls, assessment of the effects of soil structure interaction, e.g. rocking and differential settlement, etc.

2) Evaluate the lateral load resisting capacity of the existing cooling tower structure located on the roof between the Tower and the Jail buildings.

3) Review response of nonstructural elements such as elevators, ceilings, access floors, attachment of cladding and fire bricks in mechanical shafts, equipment, furniture, etc.

4) Evaluate in more detail the mechanical, electrical and architectural (including aesthetic) features of the building, especially with regard to the necessity of upgrading to current Codes and reprogramming spaces disrupted by the structural work.

5) Perform an asbestos abatement study and implement removal of asbestos as recommended in the study.

6) Develop construction phasing schemes, including extent of relocation required, noise, dust and security issues, and their impact on costs.

7) Instrument the building, particularly the roof and 9th floors, with accelerograms for correlating measured versus predicted seismic responses of critical elements such as the "911" equipment.

V. IMPACT OF RETROFIT SCHEME ON NONSTRUCTURAL ELEMENTS

V. IMPACT OF RETROFIT SCHEME ON NON-STRUCTURAL ELEMENTS

OVERVIEW

The proposed seismic retrofitting of the Police Administration Building will significantly impact nonstructural elements of the building, both during and after construction. The elements affected include architectural finishes, circulation, exiting, handicapped accessibility, loss of usable space, mechanical and electrical systems, and occupancy during construction. These impacts will cause certain areas of the building to be unoccupiable during construction. In most cases, the use of the spaces upon completion of construction will remain unchanged.

ARCHITECTURAL FINISHES

A major component of the proposed retrofit scheme is the addition of new concrete shear walls and the strengthening of existing walls by adding shotcrete. These occur in either the interior or on the exterior face of the building. Interior wall finishes in the areas affected will need to be removed and replaced. Where exterior walls are affected, existing storefront windows will need to be removed and replaced with solid concrete infill walls and new, smaller windows. The new exterior wall finishes will need to be designed to blend with the existing building facade. Where existing columns are to be encased with concrete for confinement, new finishes will need to be applied to the columns.

CIRCULATION AND EXITING

The impact of the completed retrofit on the circulation of the building will be minimal, since openings in the new shear walls will be provided where they cross corridors or other circulation paths. The most significant impact will be during the construction process, where use of some corridors or exitways may be temporarily restricted. In some areas, access to individual rooms may be temporarily cut off due to work in the corridors or entry vestibules serving the rooms. In other areas, the main corridor or exit stair serving a larger area may be affected, requiring rerouting of the circulation in that area. Where exitways are blocked and the rerouting of exit travel is not possible, a temporary exit stair may be required to allow continued occupancy of the area, otherwise the occupants must be relocated during construction. Disruption of existing stairways has been minimized as much as possible by the application of shotcrete to the exterior walls of the stairwells.

HANDICAPPED ACCESS

Access to certain areas by elevator will be temporarily impacted during construction. Certain elevators will need to be closed off due to construction work. Others will be cut off from the areas they serve. Handicapped access to these areas will need to be rerouted through unaffected elevators in other parts of the building. Some toilet facilities will be closed temporarily during construction. During this time, alternate handicapped accessible toilet facilities will need to be made available. Where space within a toilet room is lost due to new shear wall construction or other work, minimum clearances for handicapped accessibility will need to be maintained. This will require shifting over some plumbing fixture locations.

LOSS OF USABLE SPACE

Where new walls are being added or existing walls are being thickened at interior spaces, square footage will be lost in the areas affected. In some cases, this will require other walls to be shifted to maintain critical dimensions, e.g. in hallways, vestibules and toilet rooms. In other cases, existing cabinetwork, plumbing fixtures, etc. will need to be relocated or reworked. The locations of doorways may need to be shifted. New door will be required where spaces are divided into two sections by a new concrete wall. In all of these cases, impact on the functional use of the space will be minimized by providing some amount of openings in the walls, where structurally allowed.

OTHER ARCHITECTURAL FEATURES

The Courthouse Building and Administration Tower are separated from each other by 4" expansion joints. The Jail and Courthouse are separated by 2" expansion joints. Where construction of the new shear walls interferes with these joints, the joints will have to be re-established.

Seismic work planned for the roof will require patching of the existing roofing and relocation of the roof hatch and ladder. The new shear wall at the exterior west wall of the Courthouse building will require removal and replacement of the sunscreen and relandscaping at the planter boxes adjacent to the existing wall. See Appendix D for an itemized list of specific architectural impacts.

MECHANICAL AND ELETRICAL

Mechanical and electrical systems will be impacted by the proposed retrofitting project, particularly during construction. Ducts, pipes and conduit penetrations at the new shear walls or shotcreted existing walls will require temporary shutdown of these services during construction. New collector beams in the ceilings may also affect existing ductwork. These disruptions may be localized or, if a main branch is interrupted, may affect an entire area. Supply fan operations may also be affected.

Where the new shear walls occur at mechanical or electrical rooms, equipment mounted on walls to be shotcreted will need to be temporarily disconnected, removed, and replaced upon completion. Plumbing fixtures, such as the dry stand pipe and sprinkler, will need to be relocated. Many disconnects and reconnects of waste and water lines, such as the Fire Department connection, will occur where these lines interfere with the new work. Duct shaft spaces along these walls will be narrowed, causing supply and return air systems to be impacted. The existing radiant heating and cooling grid at the office ceilings will be impacted where they adjoin the affected walls. See Appendix D for an overview of the mechanical systems and an itemized list of specific impacts.

OCCUPANCY

Occupancy of the building during construction period will be difficult. Construction noise and dust in the areas adjoining the new work will be a problem. Dust barriers can be erected but they will not shut out the noise and will cause remaining areas to be constricted. Working within an occupied space will cause the contractor to work less efficiently, thus increasing construction time and cost. Temporary mechanical and electrical service will have to be provided in those areas where the existing systems are impacted. Where access to existing exitways are impeded, rerouting and/or temporary exist stairs may be required. In some rooms, where the new construction work is extensive, where entrances to these rooms are blocked, or where alternate means of

entry is not possible, relocation of occupants will be unavoidable. In other areas, the cost of relocation will need to be weighed against the costs savings in construction and the inconvenience to occupants subjected to the noise and dust. Certain high security areas, such as the property and evidence storage room, will need to be relocated since construction personnel will need access to these areas.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above impacts, the Courthouse and Administration Tower should ideally be vacated to minimize the construction cost and length of construction. If occupancy of the building must be maintained, certain areas will still require temporary relocation due to noise, dust, security and operational impacts. The neighboring parking lot could be used as surge space for these relocated functions, through the use of portable buildings. A comprehensive plan will need to be developed in conjunction with the users to determine which alternate spaces can be used and which occupants will be relocated there. In addition, a phasing plan will be required to define the extent of the building area accessible, unrestricted and restricted, to the Contractor during construction.

VI. REFERENCES

VI. REFERENCES

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2. "Design Aid on Interstory Drift", Mayes, 1993, Applied Technology Council

3. "Earthquake Spectra and Design", Newmark and Hall, Earthquake Engineering Research Institute Monograph, 1982

4. "ETABS: Three-Dimensional Analysis of Building Systems", Computers and Structures, Inc.

5. "SAP90: Structural Analysis Program:, Computers and Structures, Inc.

6. "Seismic Design Guidelines for Essential Buildings", Technical Manual TM 5-809-10-1, Departments of the Army, the Navy and the Air Force, February 1986

7. "Uniform Building Code, 1991 Eddition", International Conference of Building Officials.

APPENDIX A: EXISTING BUILDING - PLANS AND ELEVATIONS

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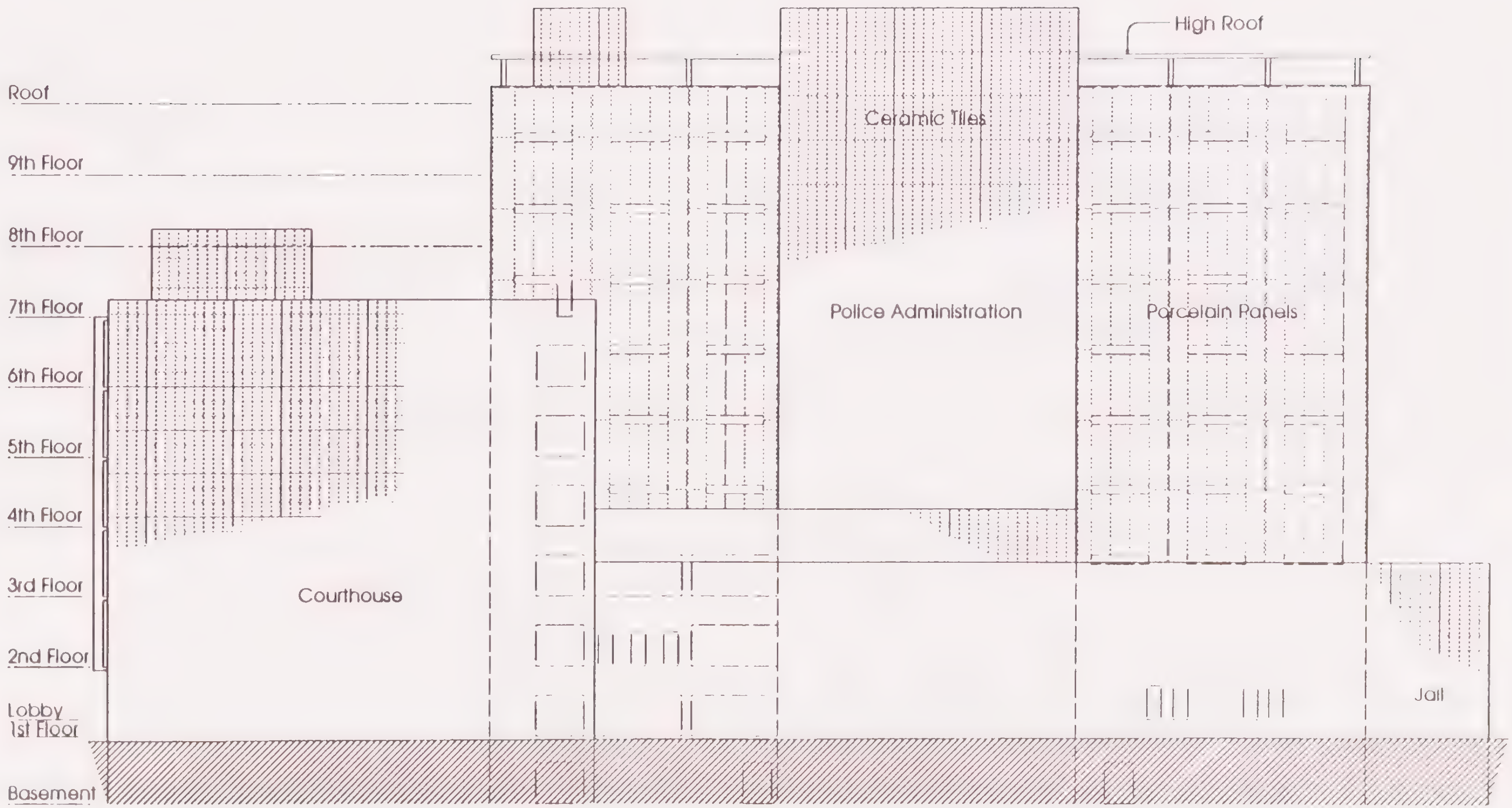


Figure A-1. South (6th Street) Elevation of Existing Building

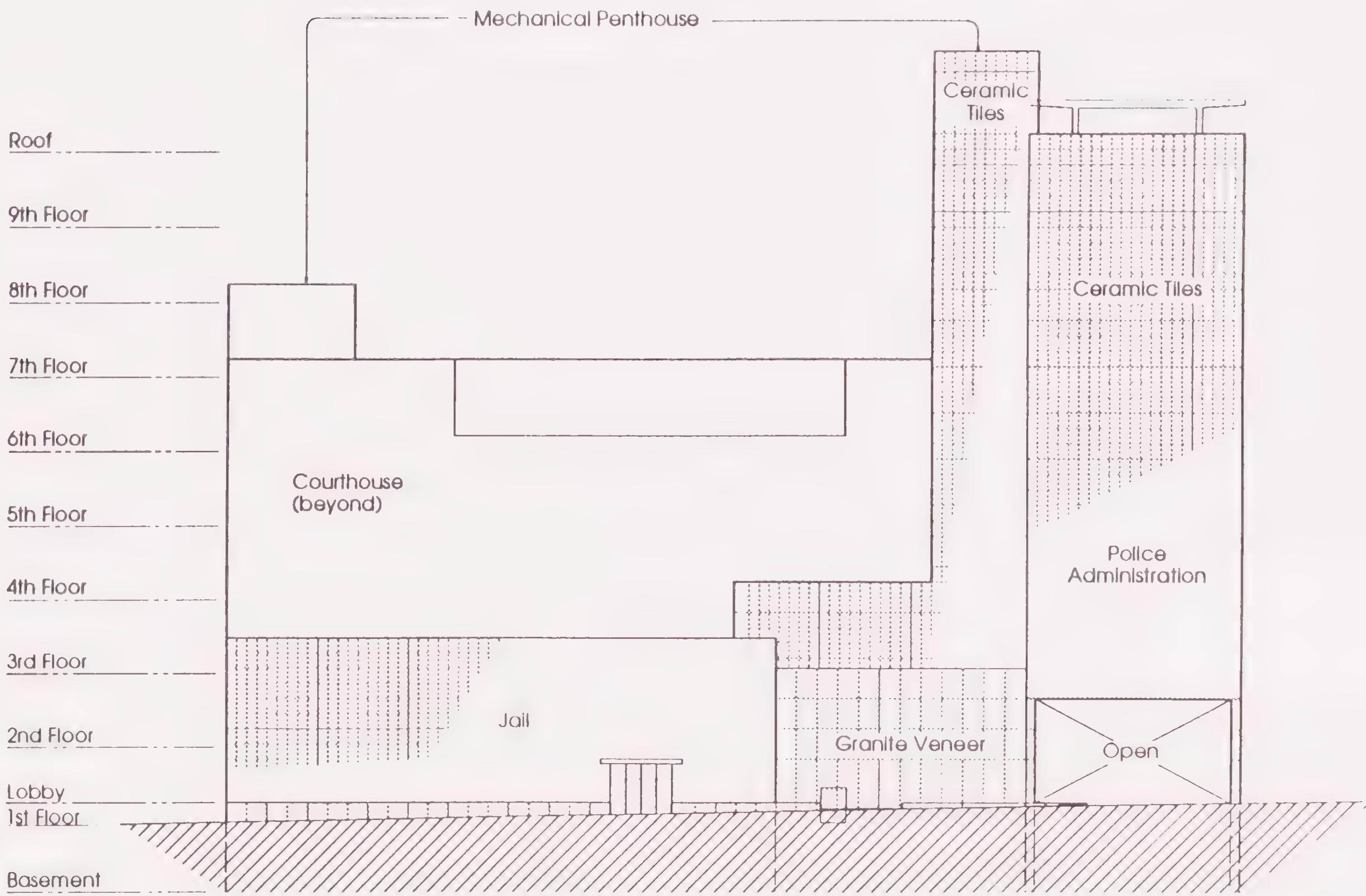


Figure A-2. East (Broadway) Elevation of Existing Building

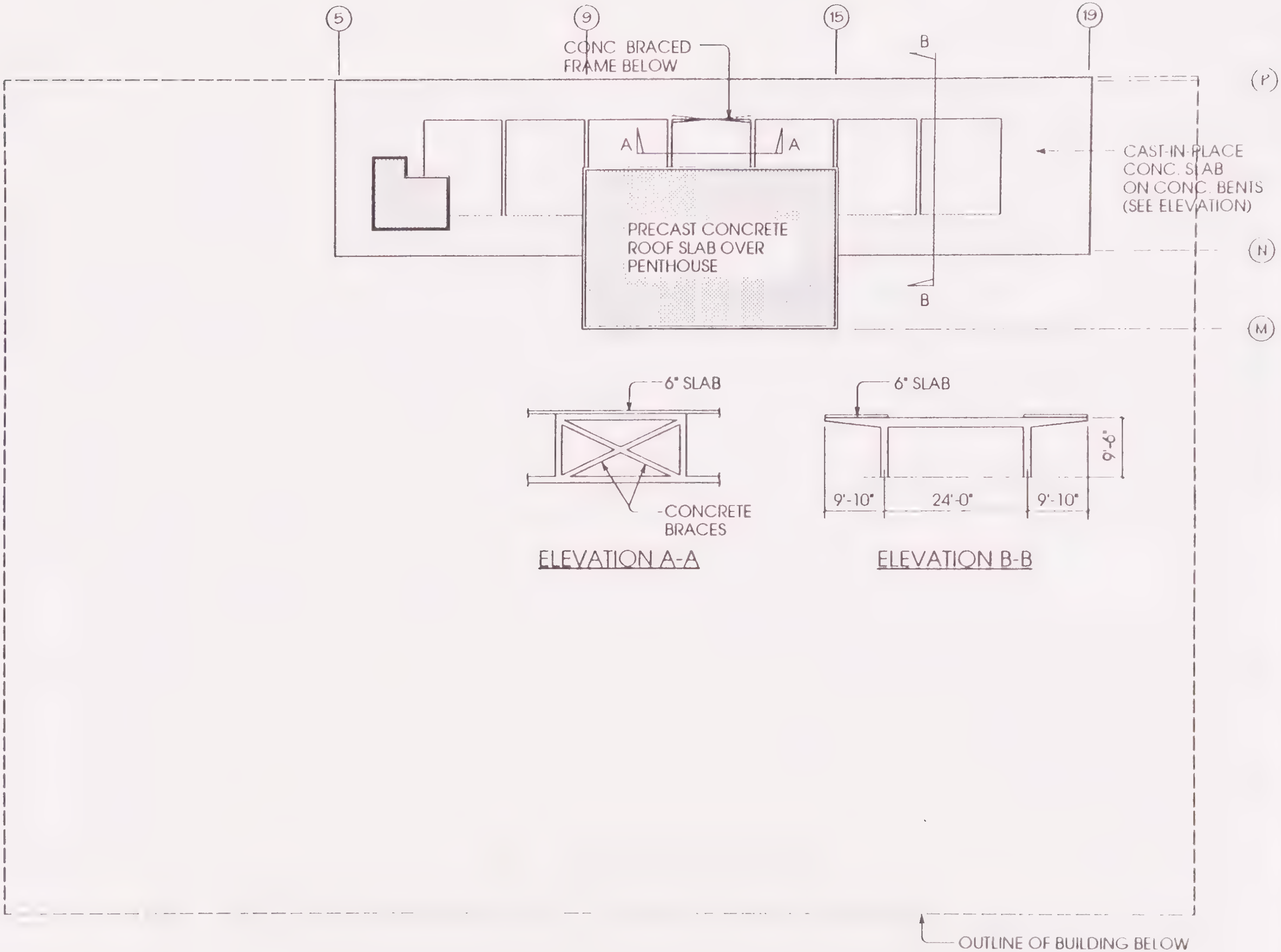


Figure A-3. High Roof Plan

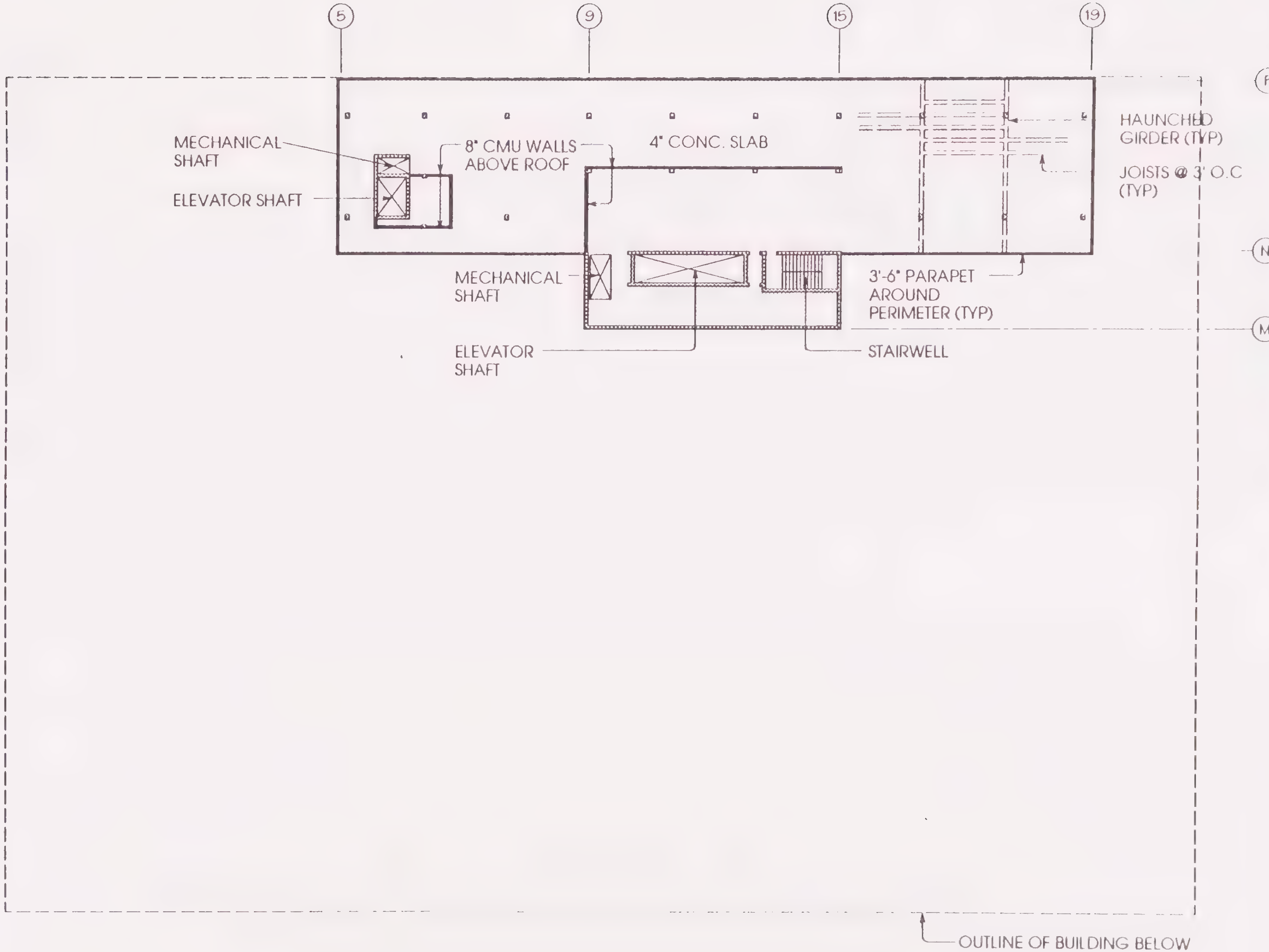


Figure A-4. Roof Plan

PAUL F. FRATESSA ASSOCIATES, INC.

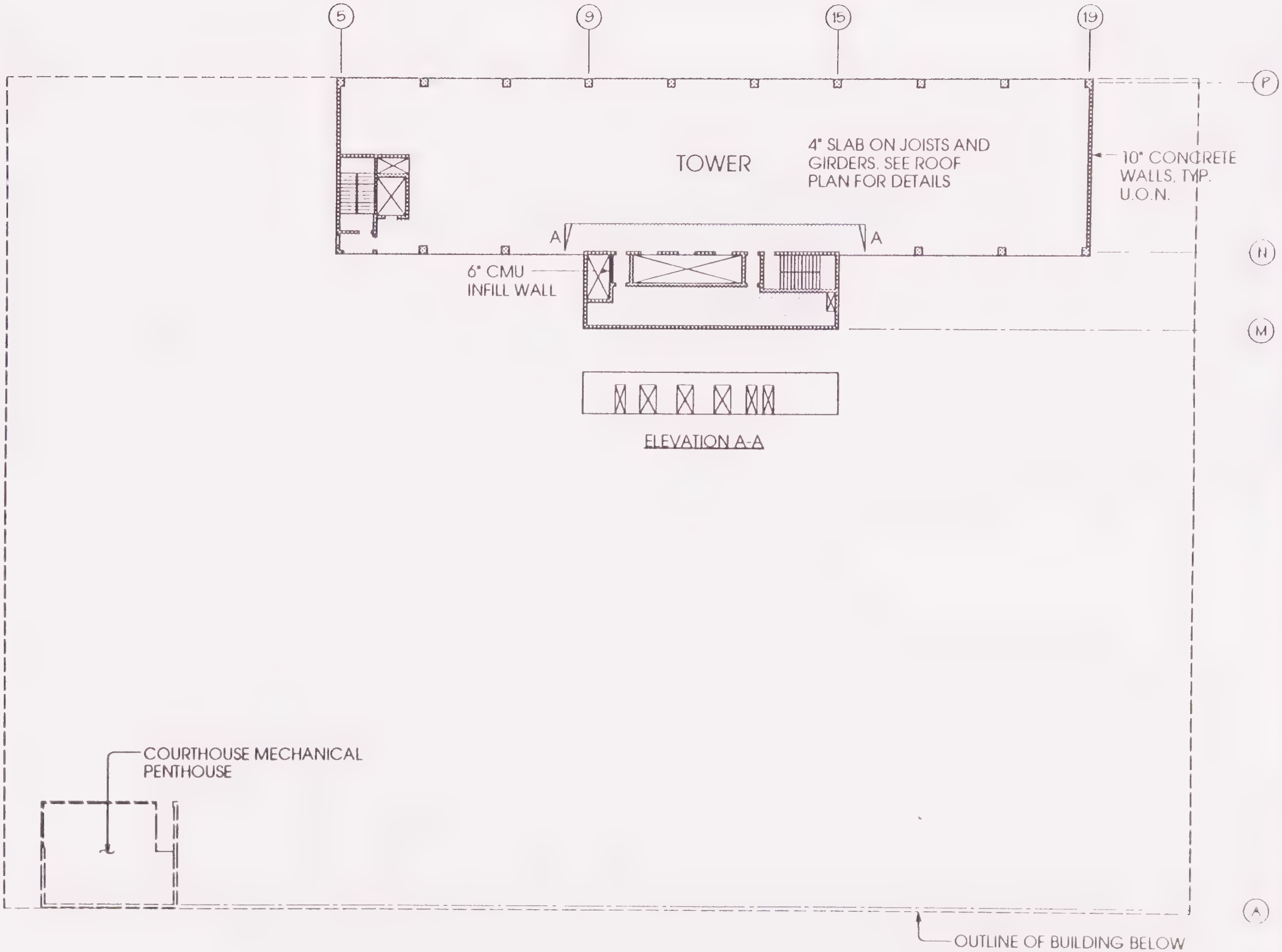


Figure A-5. Typical Tower Floor

Seismic Retrofit Evaluation for the '911' Function
Oakland Police Administration Building

City of Oakland
Office of Public Works

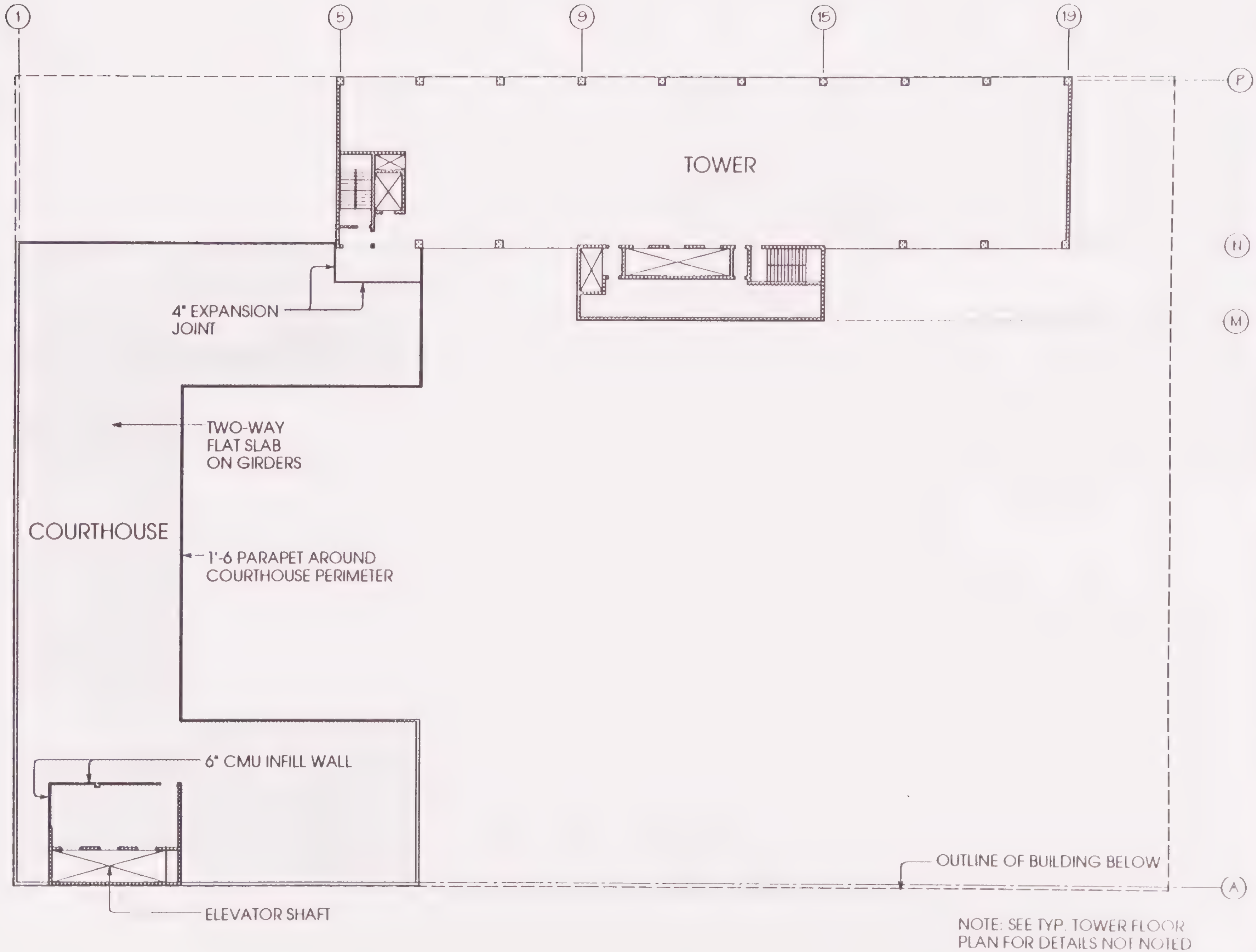


Figure A-6. 7th Floor / Courthouse Roof Plan

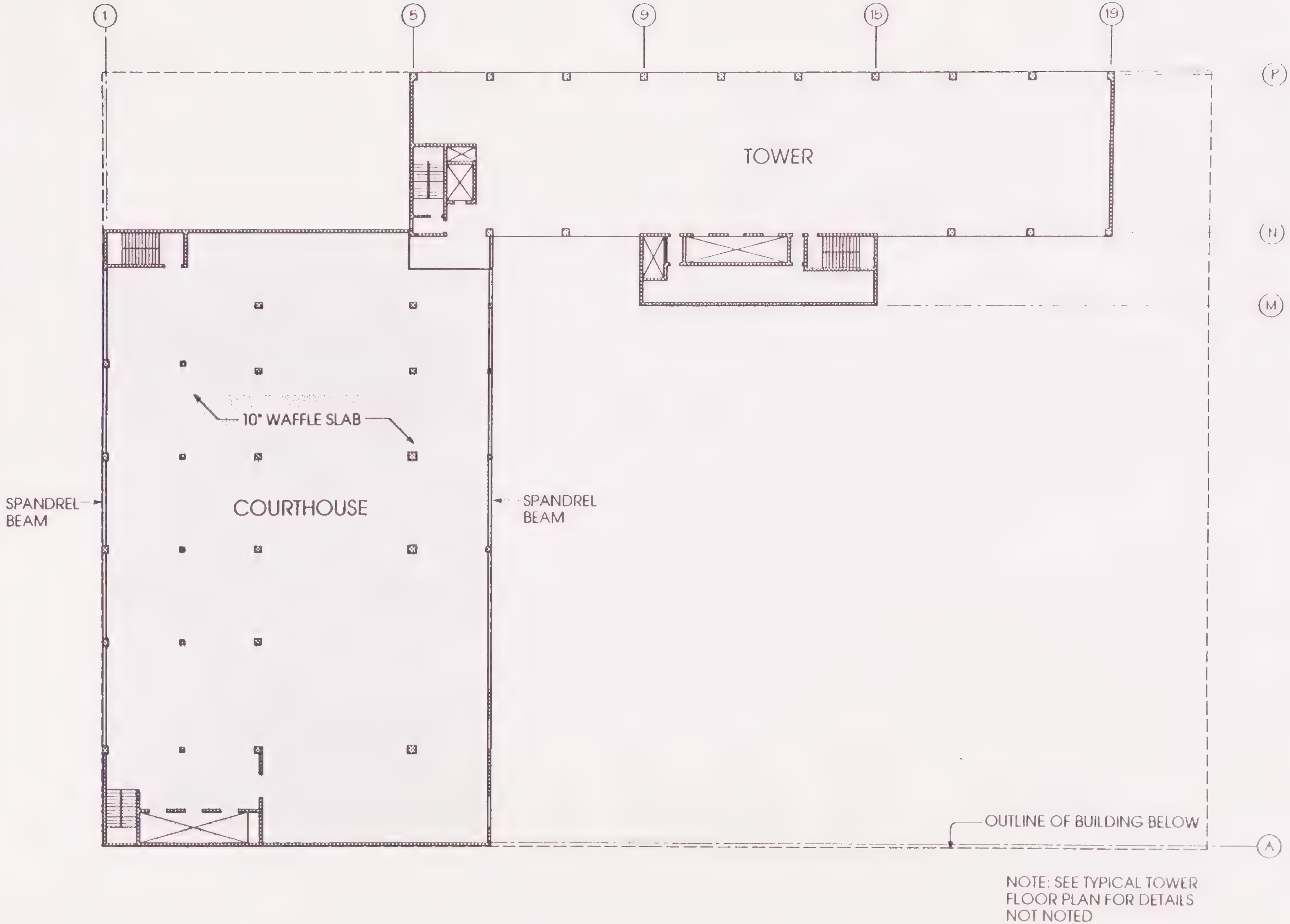


Figure A-7. 5th Floor Plan

PAUL F. FRATESSA ASSOCIATES, INC.

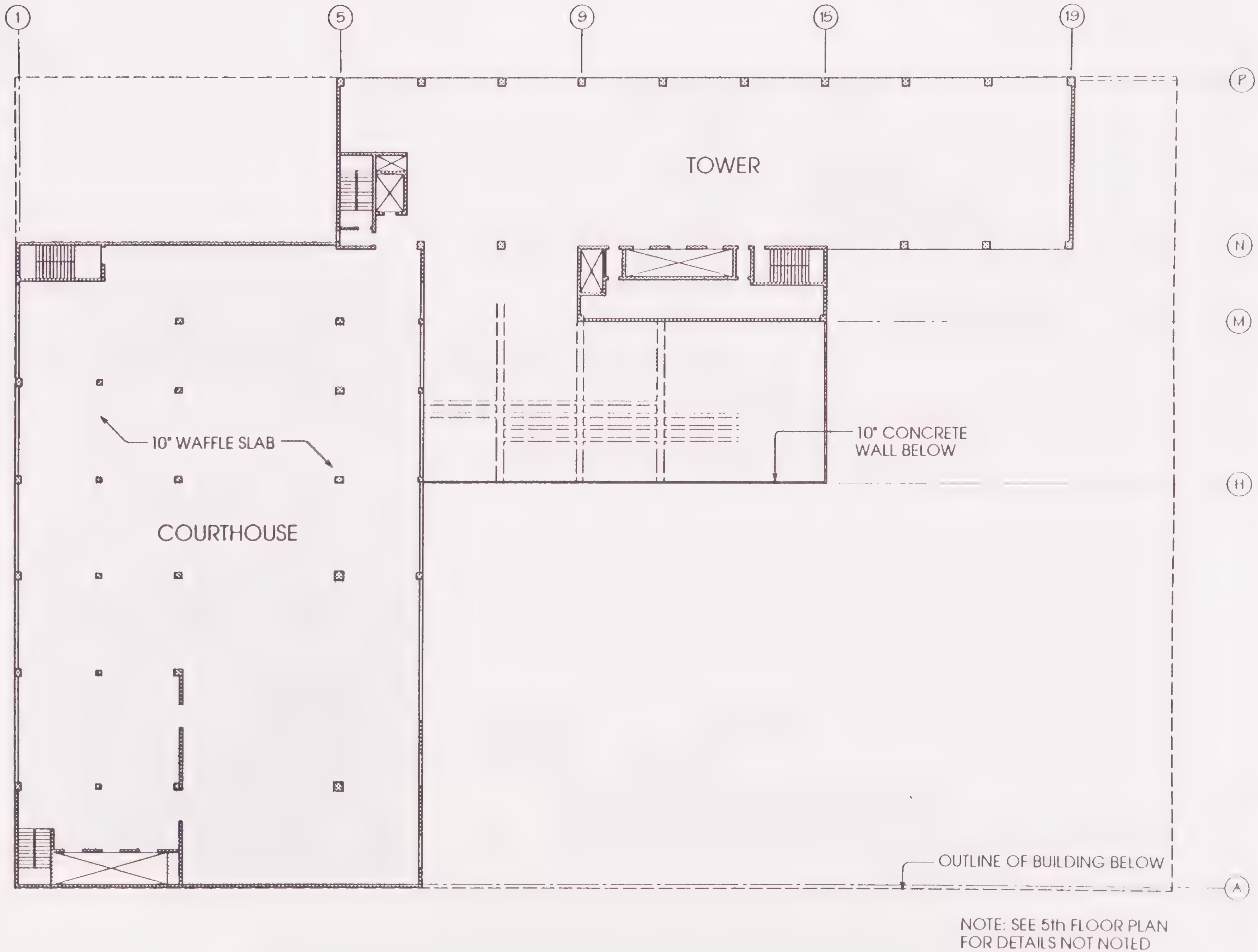


Figure A-8. 4th Floor Plan

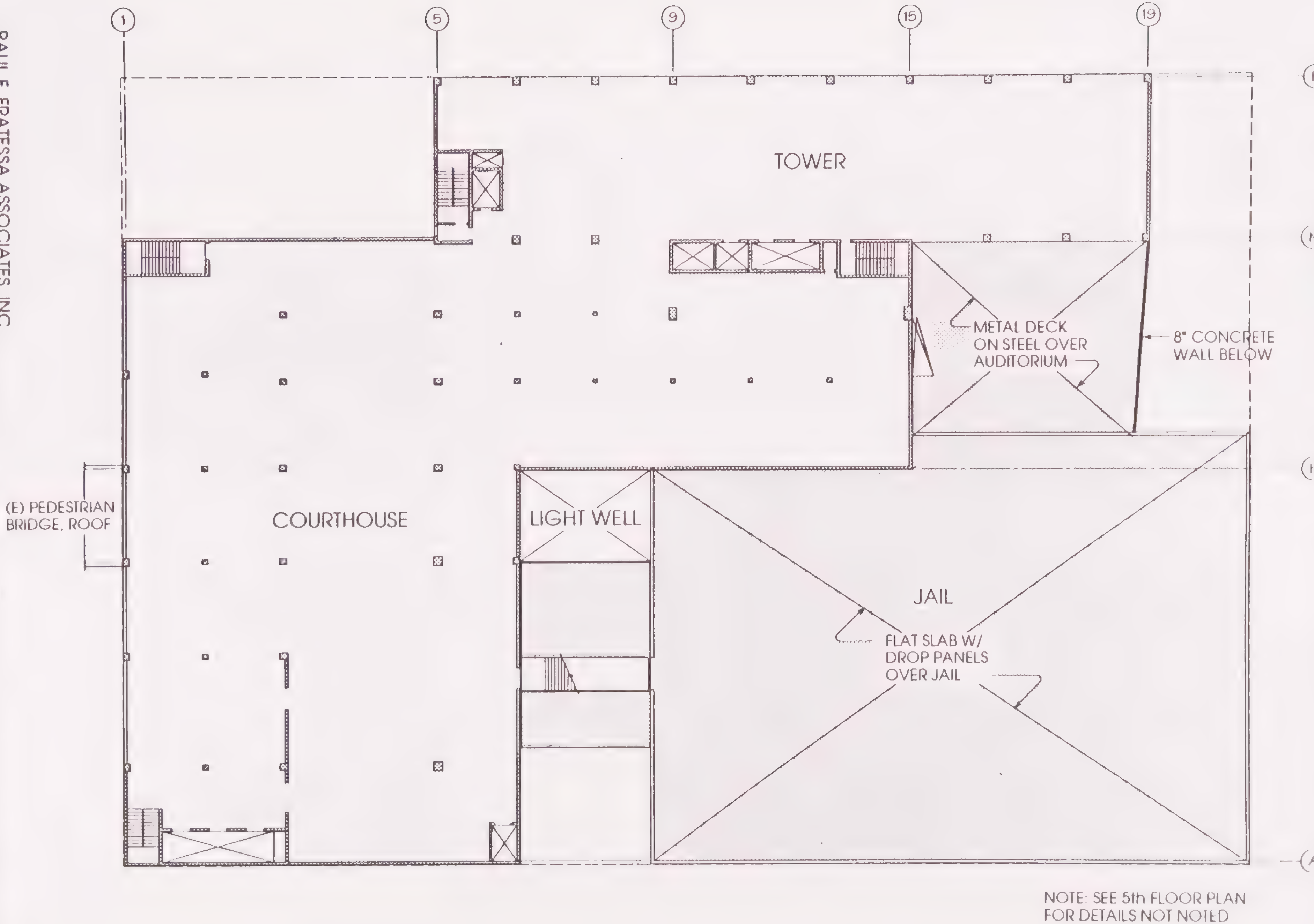


Figure A-9. 3rd Floor Plan

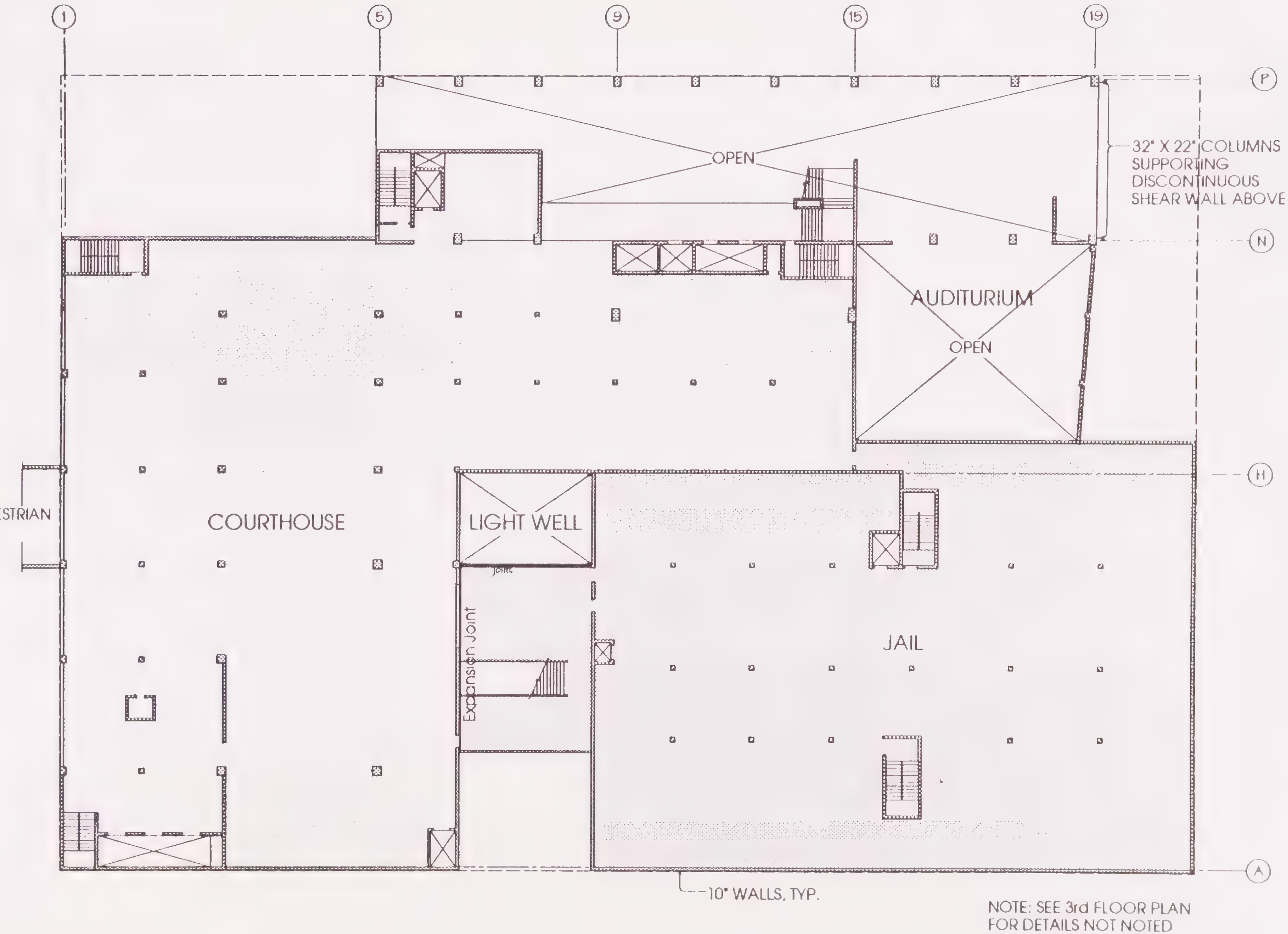
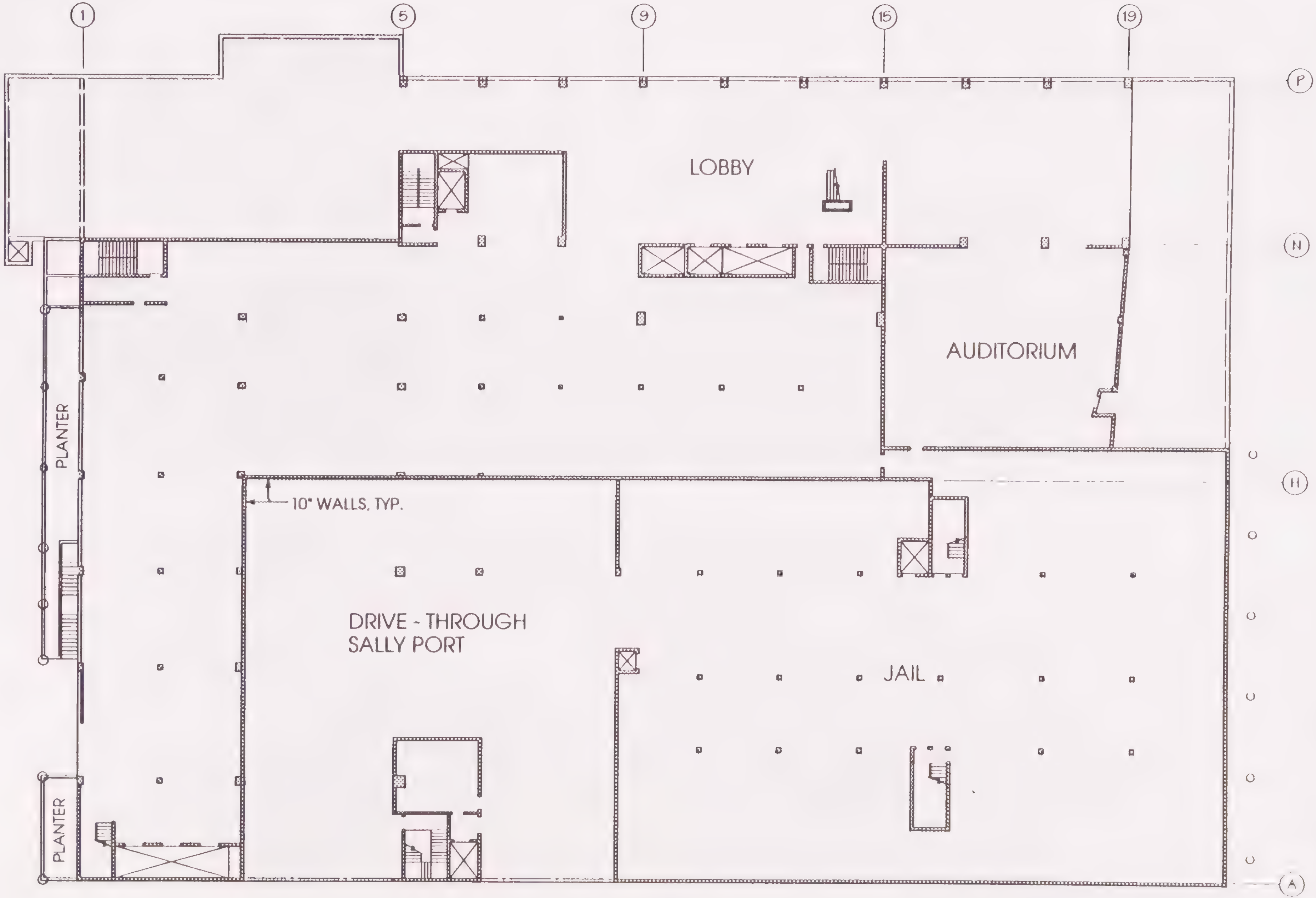


Figure A-10. 2nd Floor Plan



NOTE: SEE 2nd FLOOR PLAN
FOR DETAILS NOT NOTED

Figure A-11. 1st Floor Plan

PAUL F. FRATESSA ASSOCIATES, INC.

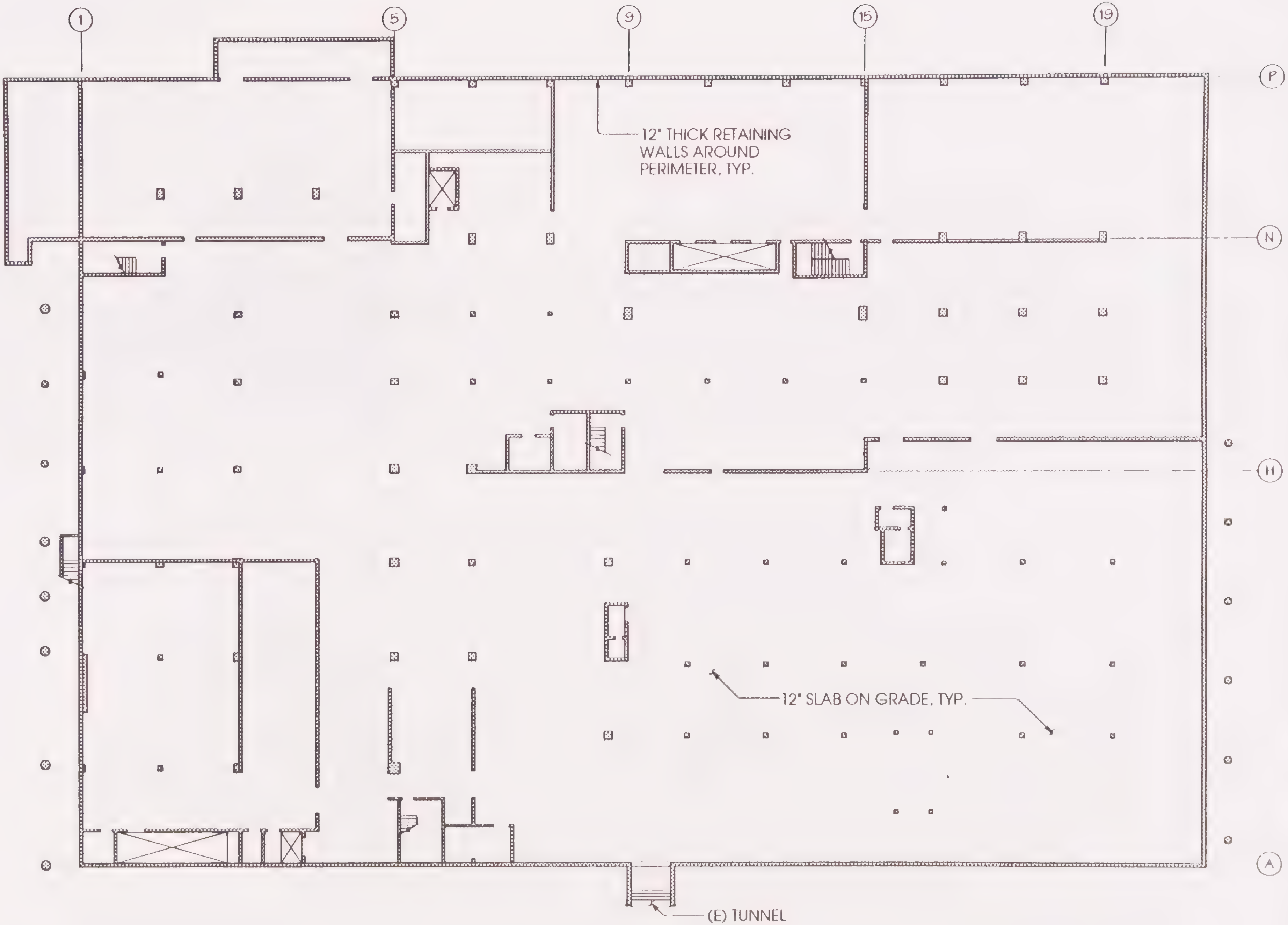


Figure A-12. Basement Plan

Seismic Retrofit Evaluation for the '911' Function
Oakland Police Administration Building

City of Oakland
Office of Public Works

APPENDIX B: TECHNICAL BACKGROUND DATA

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APPENDIX B: TECHNICAL BACKGROUND DATA

B1: POST-EARTHQUAKE EVALUATION OF BUILDINGS

Immediately after a major seismic event, a Building Inspector will visually evaluate abuilding and post it as either:

- Inspected (green) - No restriction on use or occupancy
- Limited Entry (yellow) - Entry by public not permitted. Possible major aftershock hazard.
- Unsafe (red) - Unsafe for occupancy or entry, except by authorities.

In general, there is no universally accepted criteria for visually determining the extent of hazard present in a cracked shear wall, however, Building Inspectors following guidelines provided by the Applied Technology Council (ATC) may "red tag" or "yellow tag" a building if diagonal cracks larger than 1/8 inch wide are noted in the shear walls. The damage level posted will largely depend on the Inspector's judgment.

Quantitatively, the *exact* size and location of cracks to be expected is impossible to predict, however, based on computed indices such as Inelastic Demand/Capacity ratios, general locations of damage can be identified and relative levels of damage can be estimated and addressed.

It should also be noted that other hazardous conditions, such as the presence of toxic materials, geotechnical failures, and non-structural falling hazards, could yield in a "red tag" condition; evaluation and mitigation of these hazards is not included in the scope of this Project.

B2: DESIGN EARTHQUAKE

The design earthquake used in the evaluation of the existing structure and in the development of the retrofit solution is considered to yield the realistic response for a maximum probable event. The design earthquake is based on the inelastic response spectrum defined as "EQ-II" in the Tri-Services' Technical Manual "Seismic Design Guidelines for Essential Buildings", corresponding to a maximum probable earthquake which has a 10% chance of being exceeded in 100 years. In accordance with Tri-Services Manual, a peak ground acceleration (PGA) of 0.45g and a damping value of 10% was used for this level of earthquake. The soil was classified as Soil Type 2 corresponding to stiff soils greater than 200 feet in depth.

The unreduced UBC normalized response spectrum based on a PGA of 0.4g represents an earthquake with a 10% chance of being exceeded in 50 years. The UBC spectrum is also based on a 5% damping value which was judged inappropriate for assessing the realistic response of this building. It should be noted that the UBC spectrum actually represents a less severe event (i.e. a higher risk level) than that represented by the design

earthquake. A comparison of the different levels of earthquakes is shown graphically in Figure B-1.

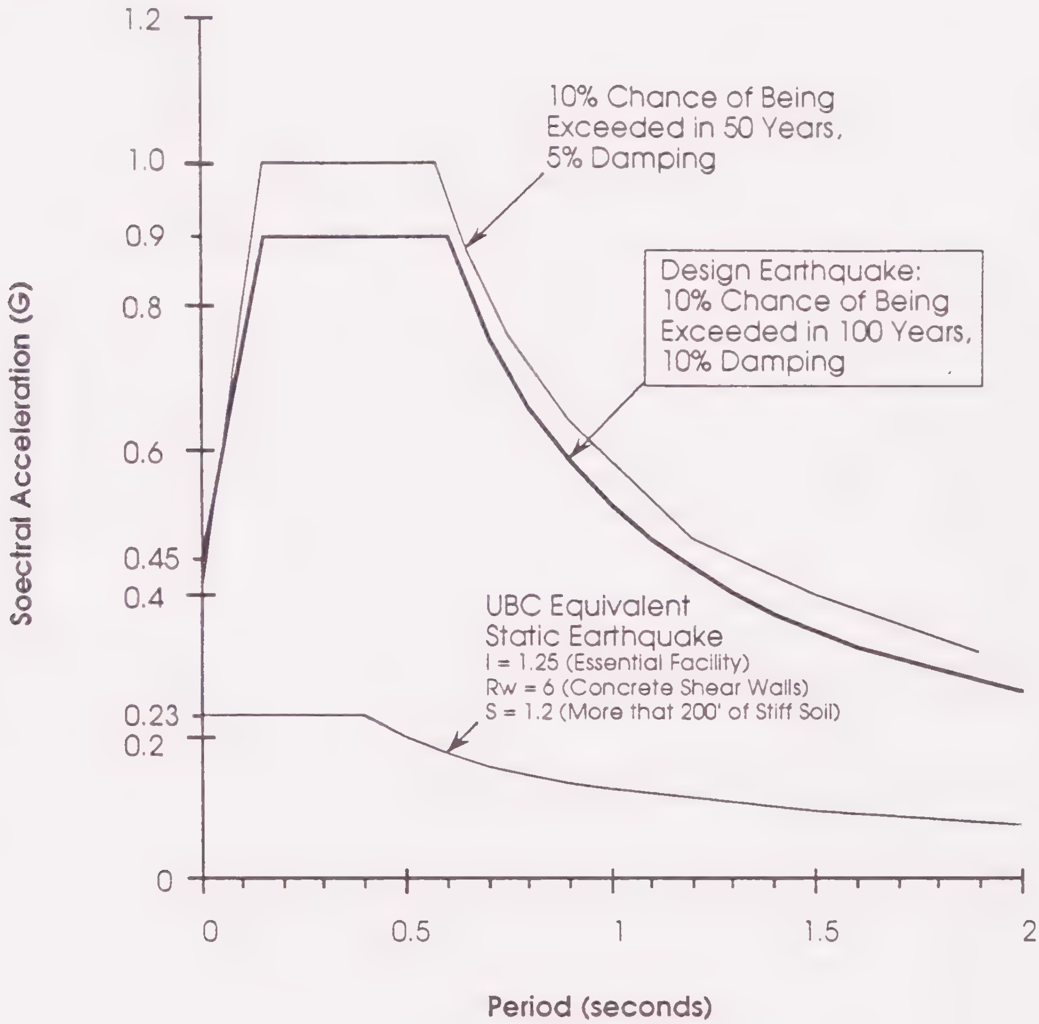


Figure B-1. Comparison of Earthquake Risk Levels

Due to the building's lack of or minimal amount of ductility, it was judged inappropriate to apply the Code-minimum level of earthquake. Ductility is the property of structural systems which enables them to undergo large deformations without failing in brittle manner. Current Codes mandate that structures have sufficient ductility to absorb and dissipate energy when subjected to several cycles of seismic loading well into the post-elastic range. Since the building was designed in 1958, prior to the adoption of modern seismic Code provisions, the building lacks the important ductility features which may prevent collapse in an extreme seismic event, therefore, the application of the "Rw" reduction factor, typically used to account for ductility in the structural system, was not considered rational for this building.

B3: THREE-DIMENSIONAL COMPUTER MODEL OF BUILDING

Due to the highly irregular structural system of the building complex, both vertically and in plan, a more rigorous analysis was deemed necessary to provide a better assessment of the actual behavior. This analysis included creating a three-dimensional mathematical

model of the building using the computer structural analysis program ETABS and subjecting the model to a dynamic analysis using ultimate level earthquake forces.

Prior to developing the three-dimensional computer model, parametric studies of a typical tower floor were performed using two-dimensional computer models and the finite element structural analysis computer program SAP90. The effects of large openings in the floor slab (i.e. structurally termed diaphragm discontinuities) were evaluated to determine their influence on the distribution of seismic forces to the shear walls. Results of these studies are discussed more fully in the next subsection.

In creating the three-dimensional computer model, the following assumptions were made:

- The building was modeled as three "towers" extending above one common three-story "base". Based on the findings of the 2-D studies described above, the Administration Building behaves as two towers and was, thus, modeled as such - the north tower consisting of the main 180'x40' area and the south tower consisting of the smaller 60'x20' area south of the elevator/stair core. The two slab areas connecting the two towers were modelled as horizontal beam-type elements. The Courthouse building formed the third tower, completely isolated structurally from the other two towers.

- The roof and floor slabs horizontal diaphragms were modeled as horizontal beam elements in the top 7 stories of the Tower and as infinitely rigid members elsewhere. Each of the three towers described above had its own system of roof and floor diaphragms, artificially displaced vertically 2 inches apart where required to simulate the separate entities.

- Gross section properties were used in modelling the columns and beams. Equivalent wall thicknesses were used in modelling the shear walls, taking into account the effects of door and window openings on the wall stiffnesses.

- The masses associated with the mechanical penthouses and rigid concrete frames and slab were lumped with the mass at the Administation roof level. Similarly, the mechanical penthouse on the Courthouse was lumped with the Courthouse roof mass.

- The slight floor offsets at the lower floors were neglected since their effect on the seismic force distribution is not significant.

- The two-story lobby entrance area in the Administration Building (termed "soft story") was simulated by disconnecting the 2nd floor from the columns along the 7th Street and Broadway sides.

- Dynamic modal effects were combined using the complete-quadratic-combination (CQC) technique. A sufficient number of modes is included such that a total of 90% of the participating mass of the structure is accounted for.

A dynamic analysis was performed on the existing building. The building's elastic dynamic response was evaluated, including the periods of vibration, story shears, maximum story inertial forces, story displacements and interstory drifts. Also, shear, flexural and axial demand forces were obtained for the column, wall and beam members and compared to computed strengths (capacities). Slab shear forces were estimated based on the loads being transferred to the walls. Soil pressures at the ends of the shear walls were estimated based on column axial loads and overturning moments at the base of the walls.

The "capacities" were computed based on elastic strengths without the reduction factor (ø) normally applied under Code-minimum evaluations. These capacities are compared to the postulated design earthquake demand forces in the form of inelastic demand/capacity ratios. Based on review of research studies, discussions with researchers and practicing structural engineers, and engineering judgment, inelastic demand/capacity ratios up to 1.25 for shear and 2.0 for flexure represent acceptable levels of damage for concrete wall and slab elements in essential facilities, consistent with the standard of care in the profession. For column elements, the maximum allowable axial loads are based on the column elastic buckling capacity. For nonessential facilities, such as the Courthouse area, the acceptable levels of damage for concrete shear walls correspond to inelastic demand/capacity ratios of 1.5 for shear and 2.5 for flexure.

In addition to the demand/capacity ratios computed for members, the interstory drifts were also computed. Although the maximum interstory drift allowed by Code is 0.005h (where h is the story height), observation of building performances in past earthquakes have indicated that significant structural damage may occur for elements lacking ductile detailing. Since little data exists on the direct relationship between drift and structural damage of shear walls, especially those of light-weight concrete, engineering judgment was applied in estimating an assumed damage limit drift of 0.003h.

Damage to nonstructural elements was also found to occur at drifts much lower than Code allowable. For example, tests have shown that "ordinary doors became impossible to operate" at story drifts greater than approximately 0.002h (Mayes, 1993). Inoperable doors represent an unacceptable condition for essential facilities such as the "911" function. Also, attachment connections of finishes, such as window walls, may be regarded as in dangerous condition at lower than Code allowed drifts.

Because the results indicated inelastic levels of response, the model was adjusted to account for cracked sections by using one half the modulus of elasticity computed for the original model. Also, to account for the additional energy dissipated by the inelastic degradation of concrete, 15% damping was assumed for the response spectrum (versus 10% damping assumed for the original model). The periods of vibration, story shears and forces, and displacements and drifts were evaluated and compared to the original elastic analyses.

Once the structural weaknesses were identified in the above analyses, various retrofit schemes were developed and evaluated by revising the original model. Similar global and local building evaluations were performed for each of the revised models.

B4: TWO-DIMENSIONAL STUDIES OF A TYPICAL TOWER FLOOR SLAB

Two-dimensional finite element models of a typical tower floor slab were used to evaluate the effects of the large openings in the floor slab. The north and south slab areas were modelled as horizontal beams, connected by "link beams" representing the 5' and 8'-9" wide sections of slab between the elevator, stair and mechanical shaft openings. The shear walls were modelled as "spring" elements with elastic stiffnesses computed manually, based on gross section properties, assuming fixed top and bottom conditions.

For earthquake loads in the east-west direction, the studies showed that the large slab openings at the elevator/stair core significantly limited the amount of shears which could be transferred to the shear walls south of the elevator wall on Line N, especially once the link beams have yielded and formed structural "hinges". Thus, the Tower actually behaves as two separate towers nominally connected by the two "link beams". The results of the east-west studies are summarized in Figure B-2 and represent the different distributions of forces to the shear walls for four cases:

1) Tower floor slab with large openings neglected.

2) Tower floor slabs in their original uncracked condition.

3) Cracked "link beam" condition approximated by using one half of the modulus of elasticity of the uncracked section.

4) Hinged link beam condition approximated by modelling as pinned end connections.

Based on the findings of these 2D studies, it was concluded that the Tower area should be modelled as two separate towers in developing the 3D model. Also, the discontinuous shear wall on Line M was identified as a critical structural weakness in the Phase I evaluation, however, the 2D studies showed that relatively little load can be transferred to this wall, therefore, the forces and stresses in it are much lower than previously estimated.

B5: 3D ANALYSIS OF EXISTING BUILDING - GLOBAL DYNAMIC RESPONSE

Using the methodology described in Section II, a three-dimensional model of the building's lateral load resisting system was created and subjected to two orthogonal directions of response spectrum earthquake loading (i.e. east-west and north-south). The analyses confirmed the structural weaknesses of the Tower identified in the Phase I evaluation and also provided important additional insight into the building behavior, summarized as follows:

1) The first mode period of vibration is 0.53 seconds and corresponds primarily to deflections in the north-south direction. This period is significantly lower than the period computed using the Code formula, i.e. T = Ct*(H)**.75 = 0.84 seconds (where Ct=0.02, H=145'). See Figure B-3.

2) Due to the eccentric layout of shear walls and masses (in the Tower and Courthouse), the torsional (i.e. twisting) modes of the building are significant and yield higher story forces, shears and displacements than would be expected for a more regular (e.g. symmetrical) layout of walls and masses.

3) The base shear coefficients from the response spectrum analysis are 0.41g and 0.40g in the north-south and east-west directions, respectively. For comparison, using the Code's equivalent static lateral force procedure with Z=0.4, I= 1.25, S=1.2, Rw=6 and periods of 0.53 and 0.84 seconds yields base shear coefficients of 0.19g and 0.14g, respectively.

4) The maximum Tower roof and 9th floor accelerations are 1.51g and 1.16g, respectively. It is not known whether or not the existing "911" equipment, including the access floor, is adequately braced for such accelerations. In comparison, Code provisions require equipment bracing be designed for accelerations of 0.75g and 0.38g for flexible/fleixibly-mounted and rigid/rigidly-mounted equipment, respectively.

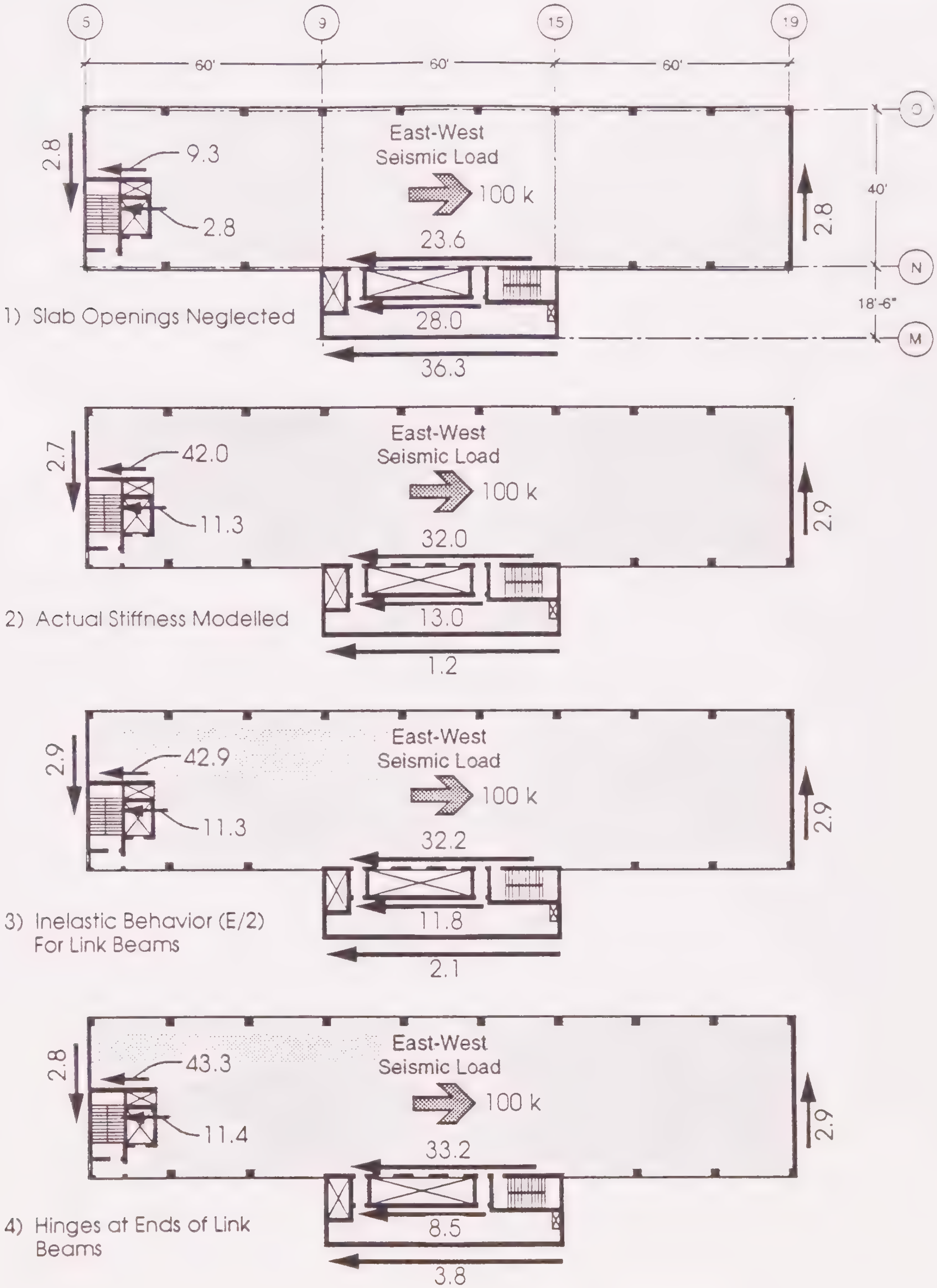


Figure B-2. Typical Tower Floor Slab Under East-West Seismic Loading

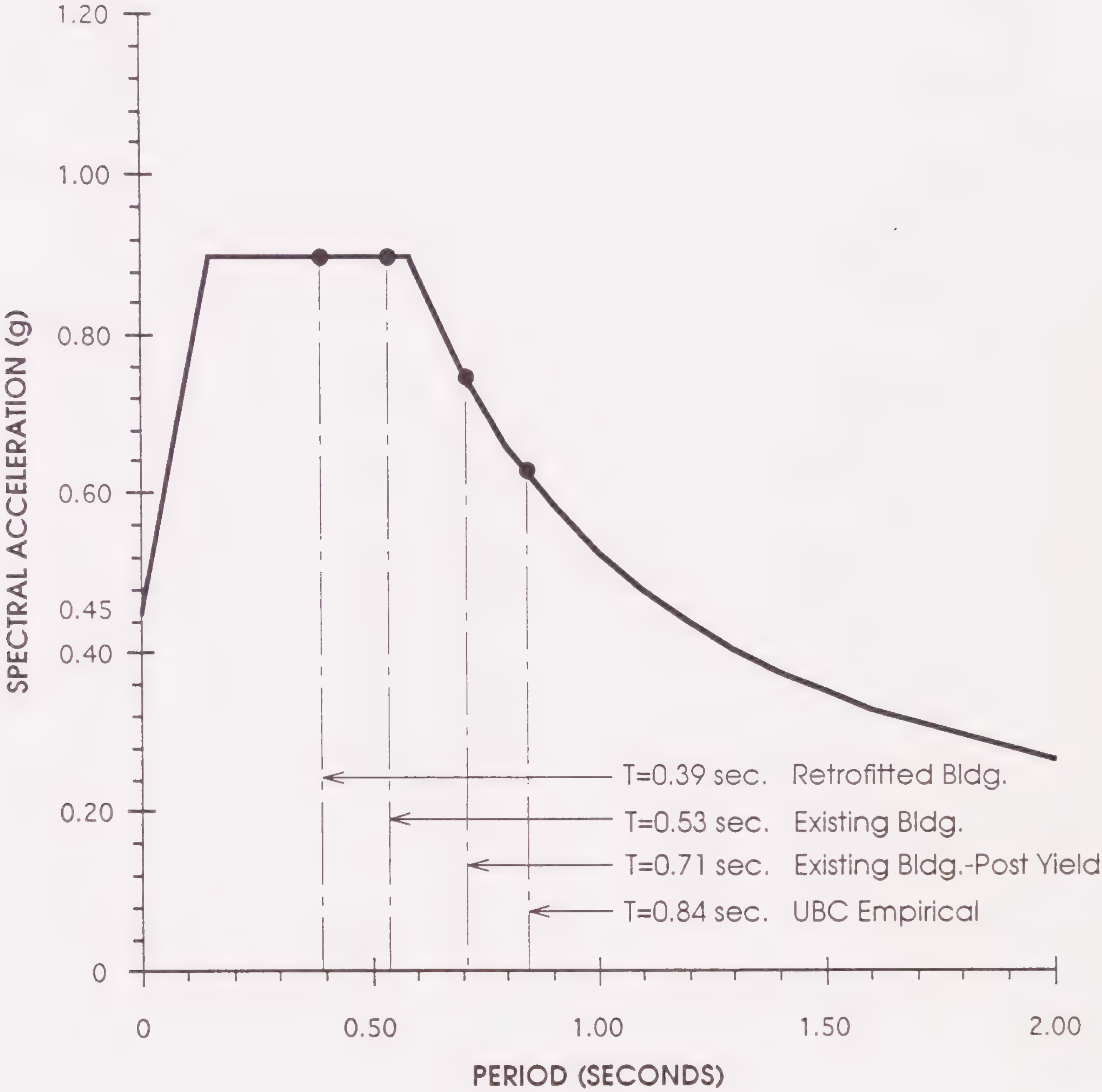


Figure B-3. Comparison of First Modes and Corresponding Spectral Accelerations

5) The maximum horizontal displacement at the corners of the Tower roof is 5.0 inches. The maximum interstory drift ratio, i.e. drift versus story height, is .0043 and occurs at the top story. This drift exceeds the assumed damage limit drift of 0.003.

6) The irregular mass distribution has a significant effect on the response of the Tower. The mass of the bottom four floors accounts for 64% of the total mass of the building; the remaining mass is distributed between the six Tower floors above (20% of the total) and the three Courthouse floors above (16% of the total). The relatively massive bottom floors "drive" the floors above, creating higher accelerations and more whip-like action in the Tower than would be experienced if the Tower were a completely isolated ten-story structure with more uniform mass distribution.

   To make this comparison, a separate 3D model of the ten-story Tower only was created, with the shear walls continued full height and regular mass distribution. Dynamic analyses of this model were performed and the results indicated a much more flexible response of the Tower, i.e. the first mode period of vibration is longer. Although the base shear coefficient, 0.50g, is higher than that for the entire building (see "3" above), the accelerations at the floors above are less, e.g. 1.0g maximum at the roof.

   Additionally, another 3D model was created which included only the bottom four floors. Dynamic analyses of this model were performed and yielded a first mode period of 0.13 seconds, base shear coefficient of 0.64g, and 4th floor acceleration of 1.35g. Comparatively, the Code static procedures yield a first mode period of 0.42 seconds, base shear coefficient of 0.22g, and 4th floor acceleration of 0.38g.

   The base shears for the entire building are 15765 k and 15559 k for the east-west and north-south directions, respectively. The base shears for the bottom four floors only are 14342 k and 15774 k for the east-west and north-south directions, respectively. Comparison of these base shears and the 4th floor accelerations indicates that the six Tower floors and three Courthouse floors above do not increase the base shear of the bottom floors proportionately to their added mass, however, they do significantly change the distribution of story forces - in general, the seismic forces attenuate up the Tower and Courthouse. See Figure B-4 for a comparison of base shear coefficients and roof/floor accelerations.

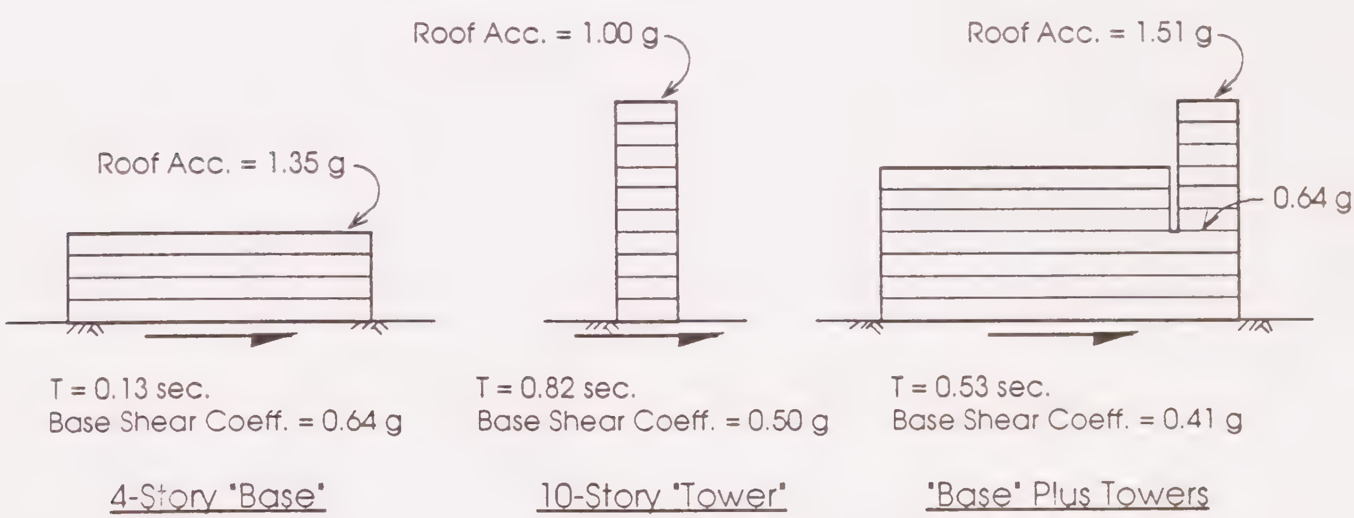


Figure B-4. Comparison of Base Shear Coefficients and Roof/Floor Accelerations

To roughly approximate the inelastic response of the building, the 3D model was revised to account for the cracked wall conditions by using one-half of the modulus of elasticity for the concrete in the shear walls. Also, 15% damping was used in the response spectrum to account for higher energy absorption induced by the grinding of the concrete in the cracked walls. The response spectrum was modified by a constant factor derived from Table 3-7 of the Tri-Services Technical Manual 5-810-10-1; these multiplier factors are based on empirical relations given by Newmark and Hall (Ref. 3).

Dynamic analyses of this model yielded a longer first mode period of vibration, 0.71 seconds. The longer period indicates the building "moves down" the response curve, off the plateau - see Figure B-3. This yields lower forces and accelerations throughout the building. Also, the combined displacements at the Courthouse roof and Tower 7th floor exceed the 4" seismic gap, therefore, pounding is likely to occur.

B6: THREE-DIMENSIONAL ANALYSIS OF RETROFITTED STRUCTURE

Using the methodology described in Section III of this report, the three-dimensional model was adjusted to correspond to the recommended retrofit scheme and dynamic analyses were performed using the same design earthquake applied to the original building. The new concrete was assumed to consist of normal-weight aggregate with design compressive strength of 6000 psi with 60 ksi deformed bar reinforcing steel. In general the retrofit scheme provides the strength and stiffness required for the postulated seismic forces, however, the new concrete increases the building mass and the corresponding floor accelerations. Also, the stiffened building has a shorter first mode period of vibration which still falls in the "plateau" section of the response spectrum - see Figure B-3.

Results of the global dynamic response are summarized as follows:

1) The first mode period of vibration is computed to be 0.39 seconds and corresponds primarily to deflections in the north-south direction.

2) The base shear coefficients are 0.47 and 0.44 in the north-south and east-west directions, respectively, slightly higher than those for the original building.

3) The maximum Tower roof and 9th floor accelerations are 1.59g and 1.22g, respectively, roughly 5% higher than the original building accelerations.

4) The maximum horizontal displacement at the corners of the Tower roof is 2.42 inches. The maximum interstory drift ratio is .0022.

5) The combined maximum elastic displacements of the Courthouse roof and the 7th floor of the Tower are 1.09 and 1.66 inches in the east-west and north-south directions, respectively. Based on these values, even if multiplied by a factor of 2 to account for post-yield (i.e. cracked wall) conditions, the existing 4" seismic gap should be sufficient to preclude pounding between the Tower and the Courthouse.

B7: COMPARISON WITH UNIFORM BUILDING CODE APPROACH

For purposes of comparison only, the Uniform Building Code provisions were applied to determine the building base shear and distribution of forces over the height of the building. Since the Code formula for estimating the building period is simplified and

empirical in nature, it does not reflect the actual response of the building as accurately as the 3D ETABS model. The Code formula does not take into account irregular mass and stiffness distributions nor amount of shear walls nor multi-tower effects. As an example, the building periods determined from the 3D modal analyses are 0.53 seconds and 0.39 seconds for the original and retrofitted structures, respectively. Using the Code formula, the building period is 0.84 seconds for both the original and retrofitted structures!

To compare the Code values with the Design Earthquake values, a load factor of 1.4 and strength reduction factor of 0.6 (for shear in shear walls) was applied to the Code-derived base shear coefficients and roof forces. The Code formula for distributing the shears over the height of the building, also simplified and empirical in nature, was applied for different assumed building periods. The results indicate that in general the Code distribution approaches the 3D distribution as the period decreases, i.e. as the building gets stiffer. For the "actual" periods, the Code-derived base shears and roof forces are within 10% of those of the 3D models. See Table 1 below for a summary of the above comparisons.

COMPARISON OF 3D DYNAMIC DESIGN EARTHQUAKE VERSUS CODE APPROACH	Period (seconds)	Base Shear Coefficient (k)	Seismic Force at Roof (k)	Roof Acceleration (g)
EXISTING BUILDING				
• Code Approach	0.84	0.33	2394	1.14
• Code Approach for Given Period	0.53	0.44	2926	1.39
• 3D Dynamic Approach	0.53	0.40	3170	1.51
RETROFITTED BUILDING				
• Code Approach	0.84	0.33	2385	1.20
• Code Approach for Given Period	0.39	0.23	3236	1.63
• 3D Dynamic Approach	0.39	0.47	3156	1.59

Table 1. Comparison of 3D Dynamic Design Earthquake Vs. Code Approach

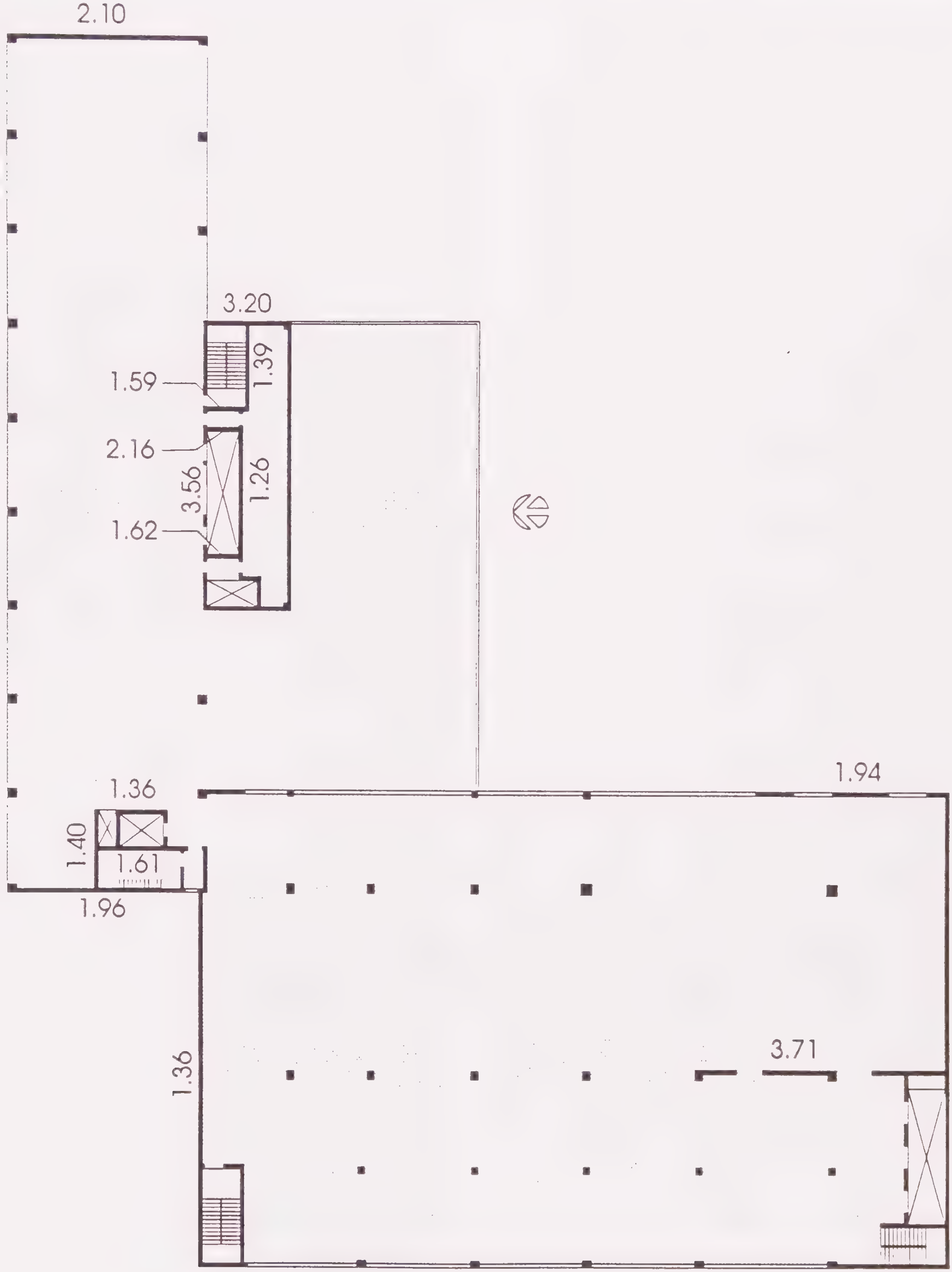


Figure B-5. Existing Building 4th Floor Plan with Inelastic Demand/Capacity Ratios

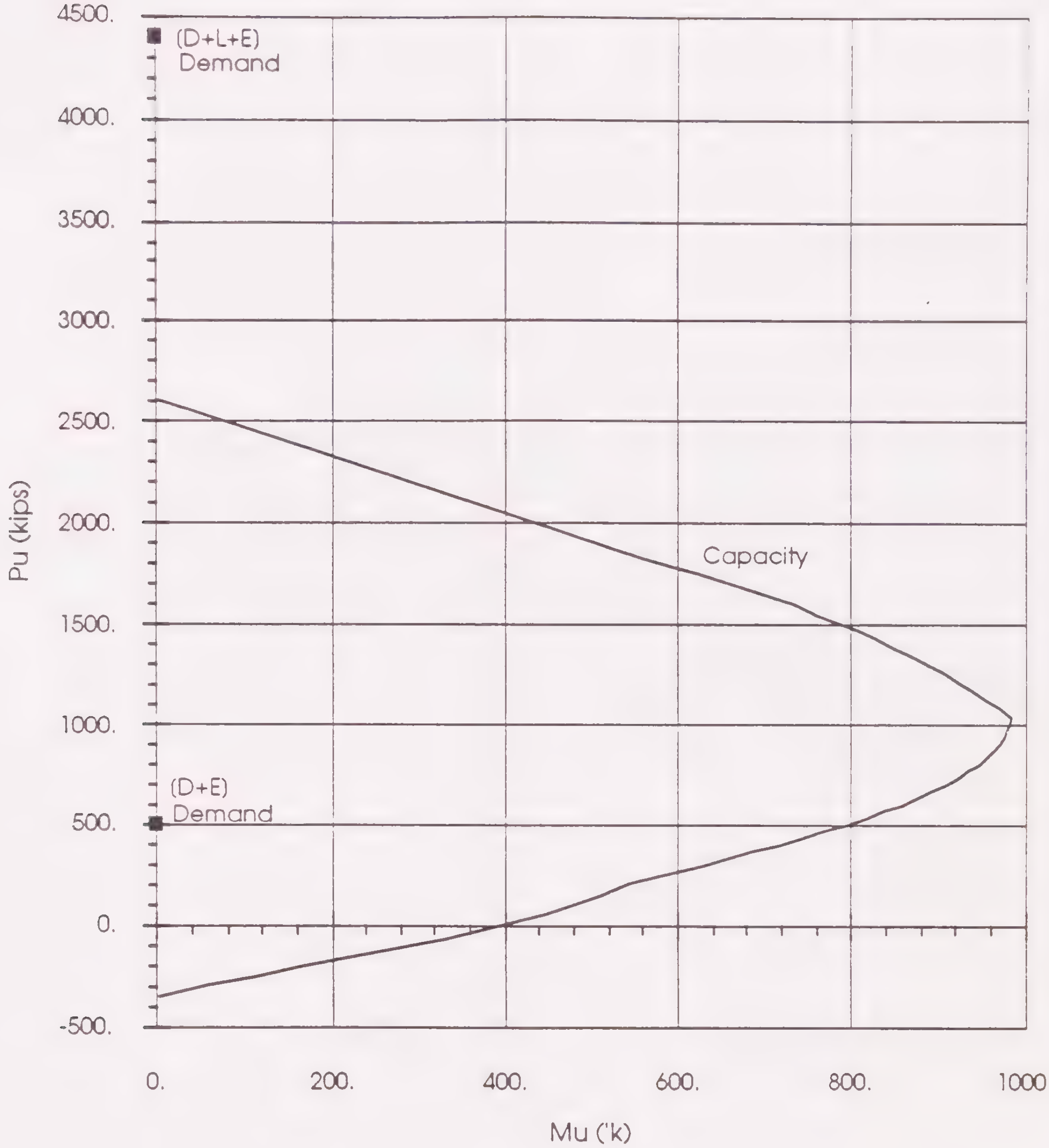


Figure B-6. Interaction Diagram for Existing Concrete Column at P/19 Below 2nd Floor

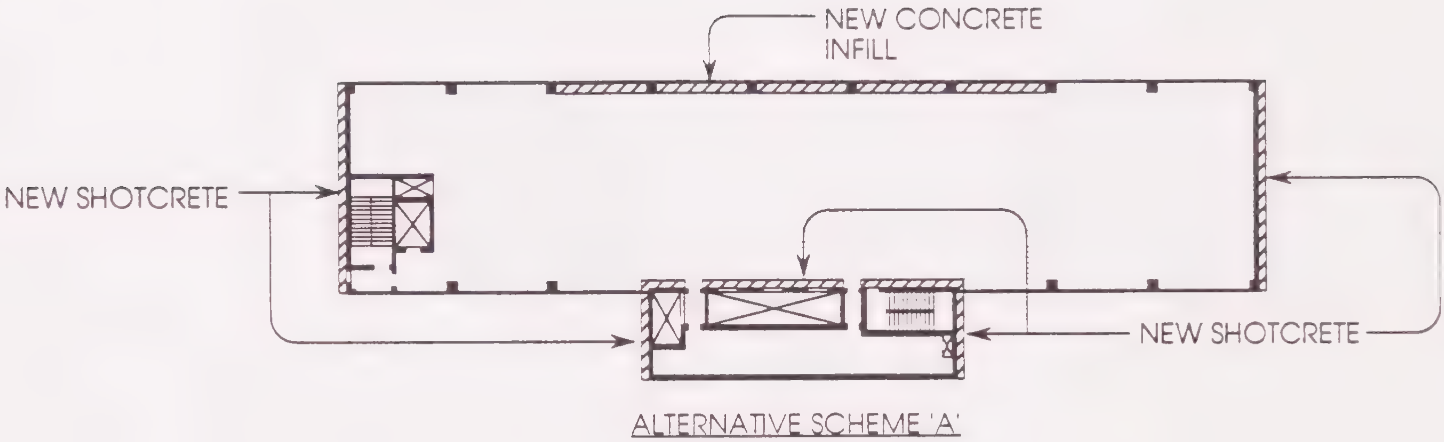


Figure B-7. Alternative Retrofit Scheme A- Typ. Tower Floor

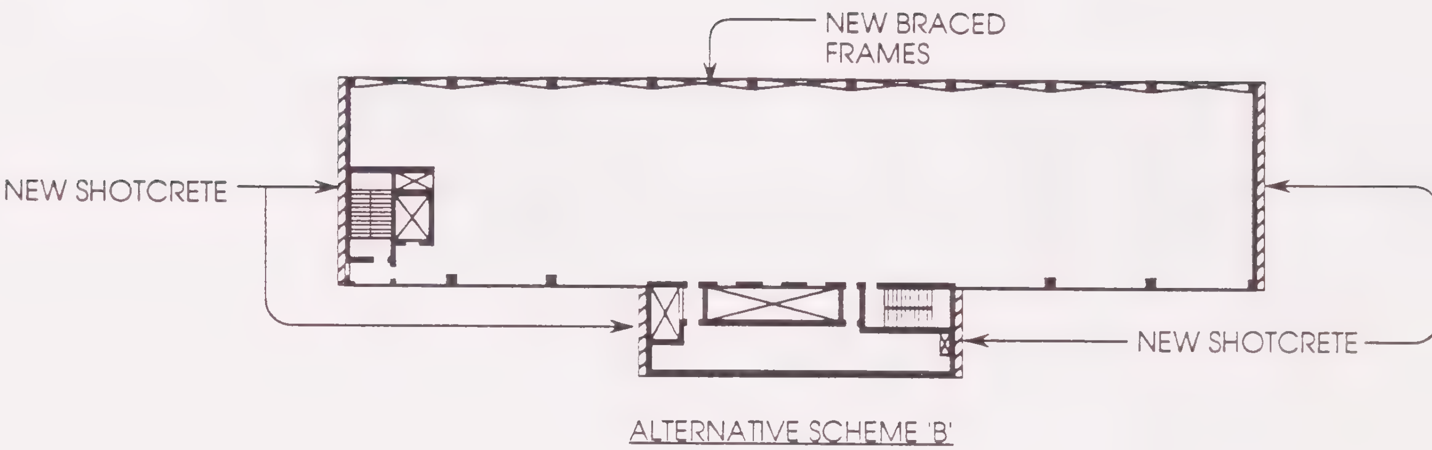


Figure B-8. Alternative Retrofit Scheme B- Typ. Tower Floor

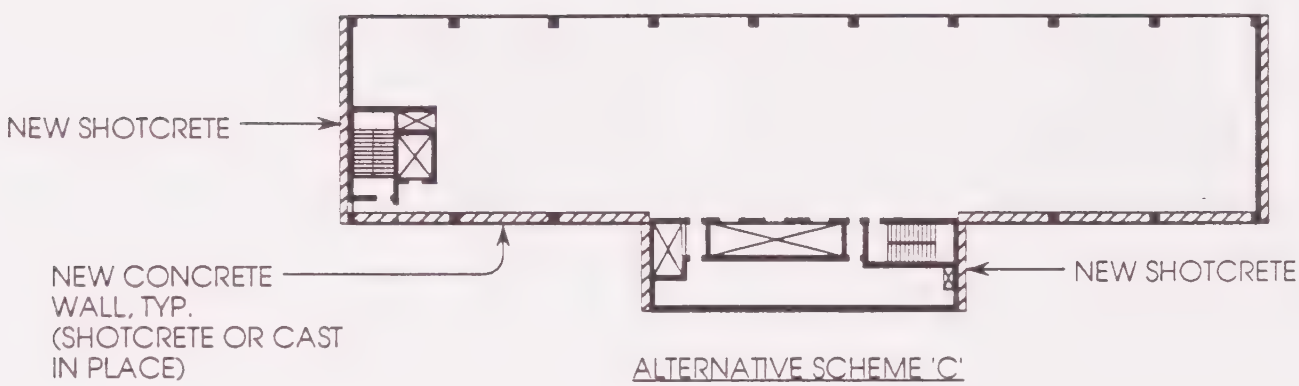
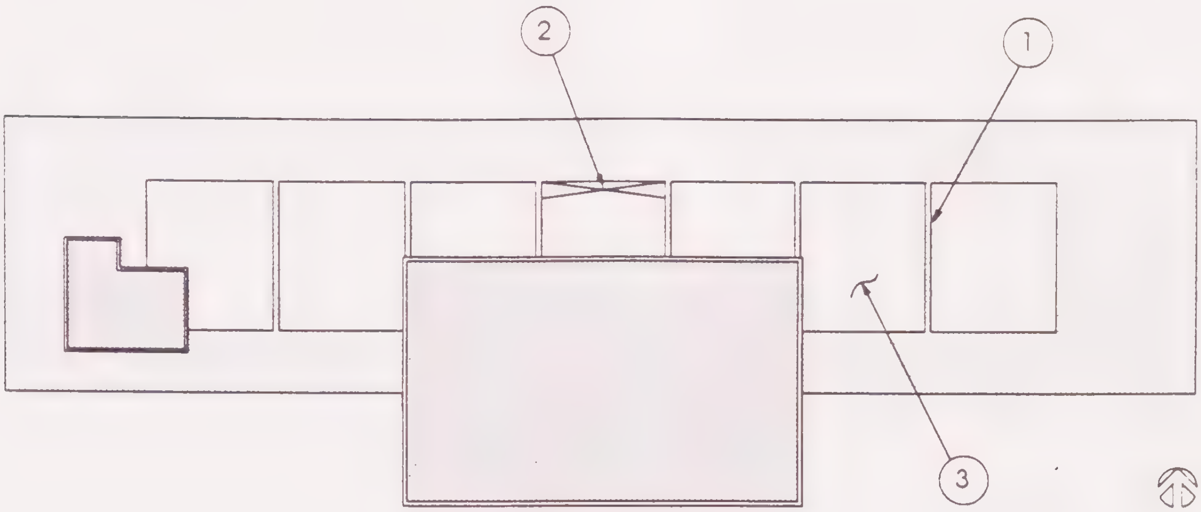


Figure B-9. Alternative Retrofit Scheme C Typ. Tower Floor

APPENDIX C: RECOMMENDED RETROFIT SCHEME

LIST OF FIGURES



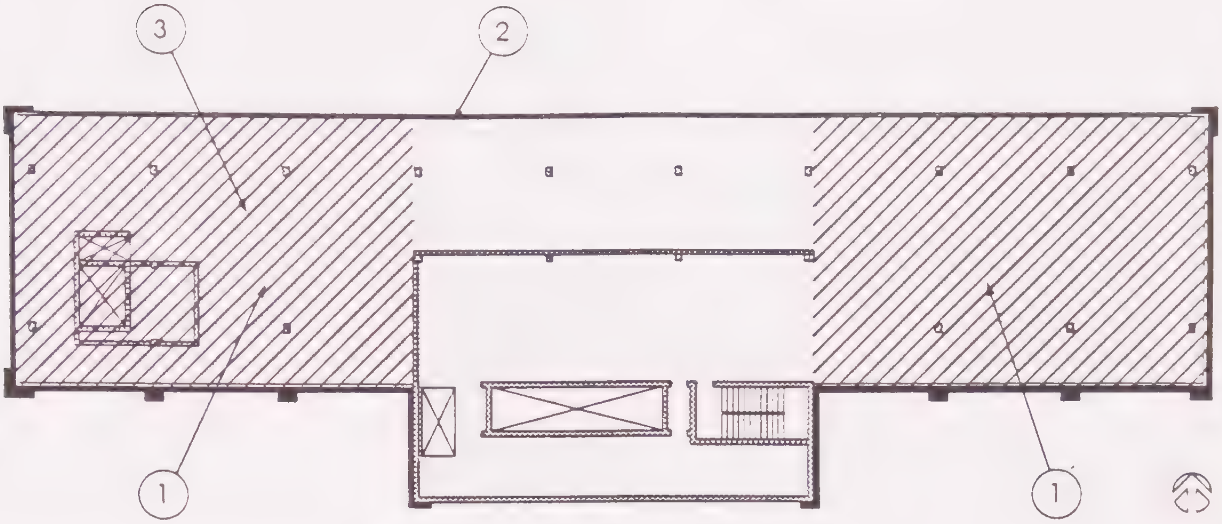
(1) Remove Concrete Slab and Rigid Bents

(2) Remove Concrete X-Brace

(3) Remove and Replace Existing Equipment, Antennae, Etc. on Roof (not shown)

See Figure A-3 for Existing Building Details

Figure C-1. Retrofit Scheme - High Roof Plan



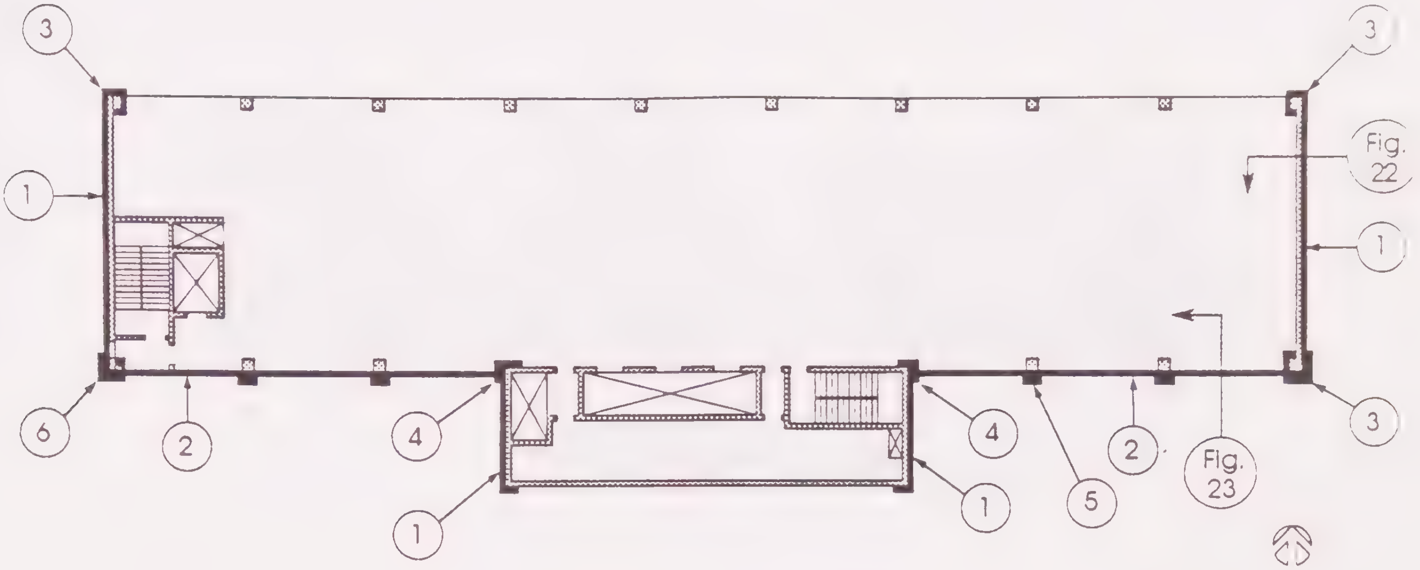
1 Remove Existing Roofing and Topping Slab. Add New 4" Concrete Dowelled to Roof Slab.

2 Form Curb for Waterproof Connection to Vertical Walls, Typ.

3 Traffic Top Waterproof Membrane at New and Existing Exterior Walkways, Typ.

See Figure A-4 for Existing Building Details

Figure C-2. Retrofit Scheme - Roof Plan



1. New Shotcrete on Existing Wall
2. New Concrete Wall
3. Corner Column Encasement - See Figure 24
4. Column at Ends of Elevator Wall - See Figure 25
5. Typical Intermediate Column - See Figure 27
6. Column at N/5 - See Figure 28

See Figure A-5 for Existing Building Details

Figure C-3. Retrofit Scheme - 9th Floor Plan (Similar at 8th, 7th, & 6th Flrs.)

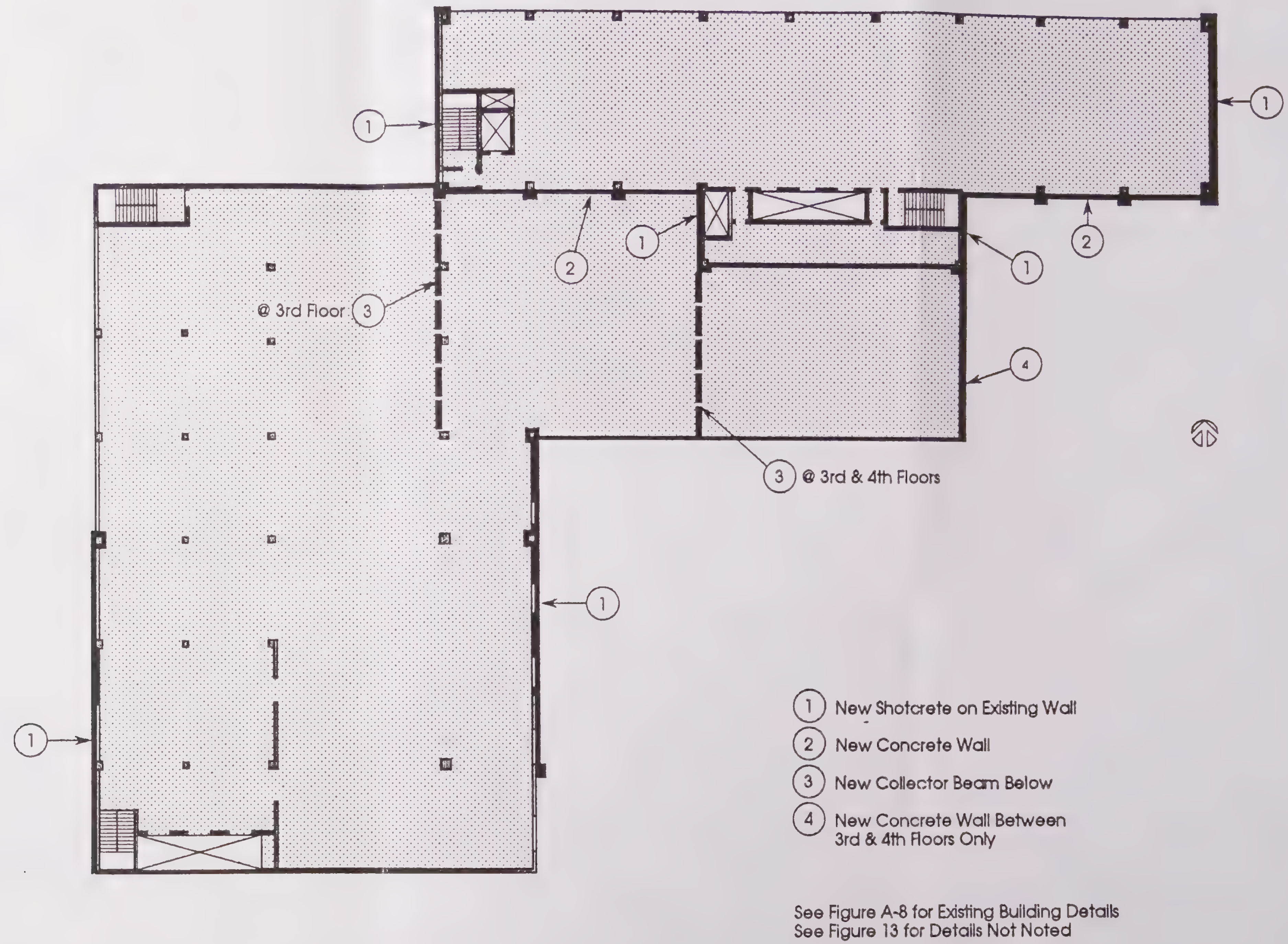
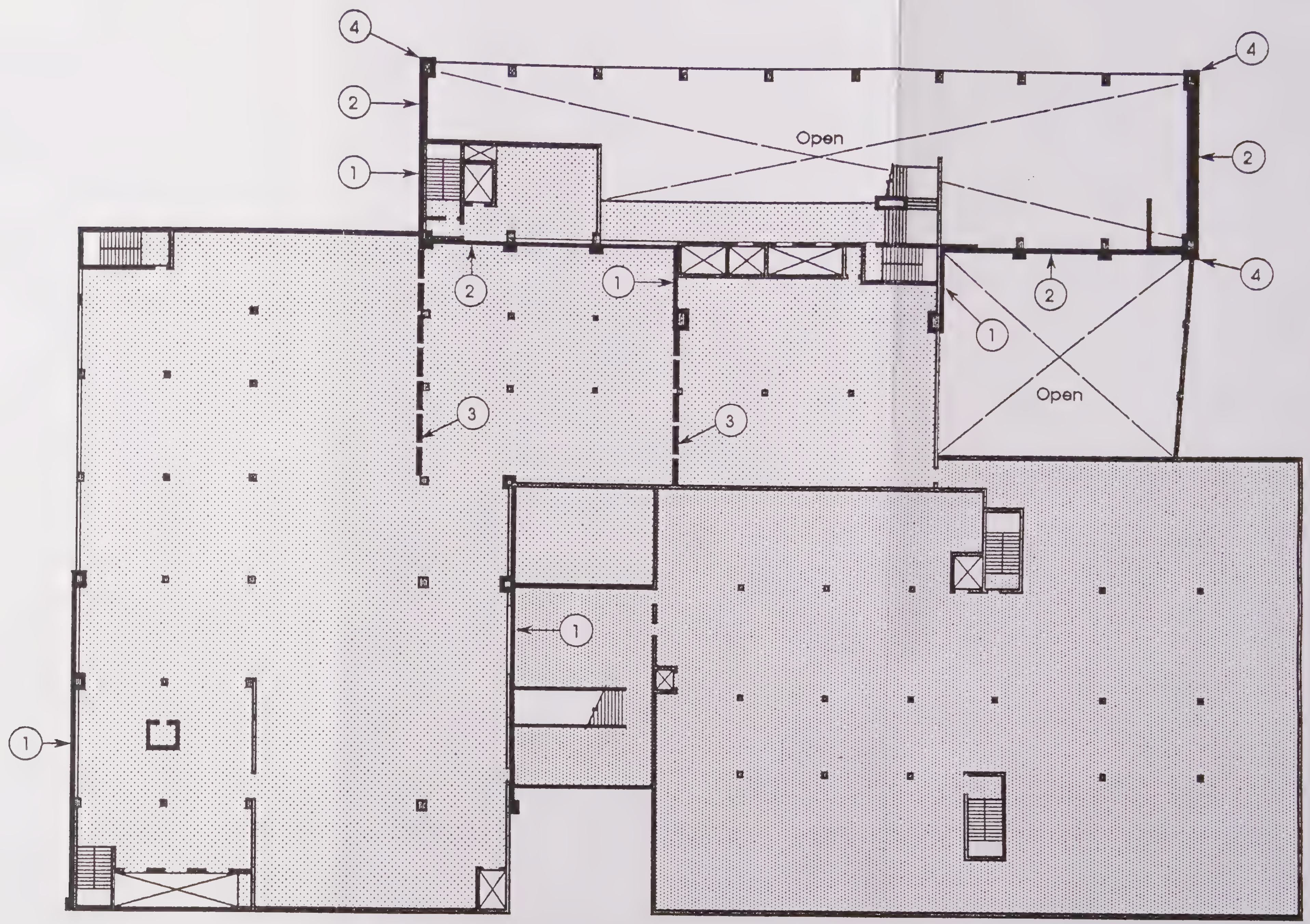


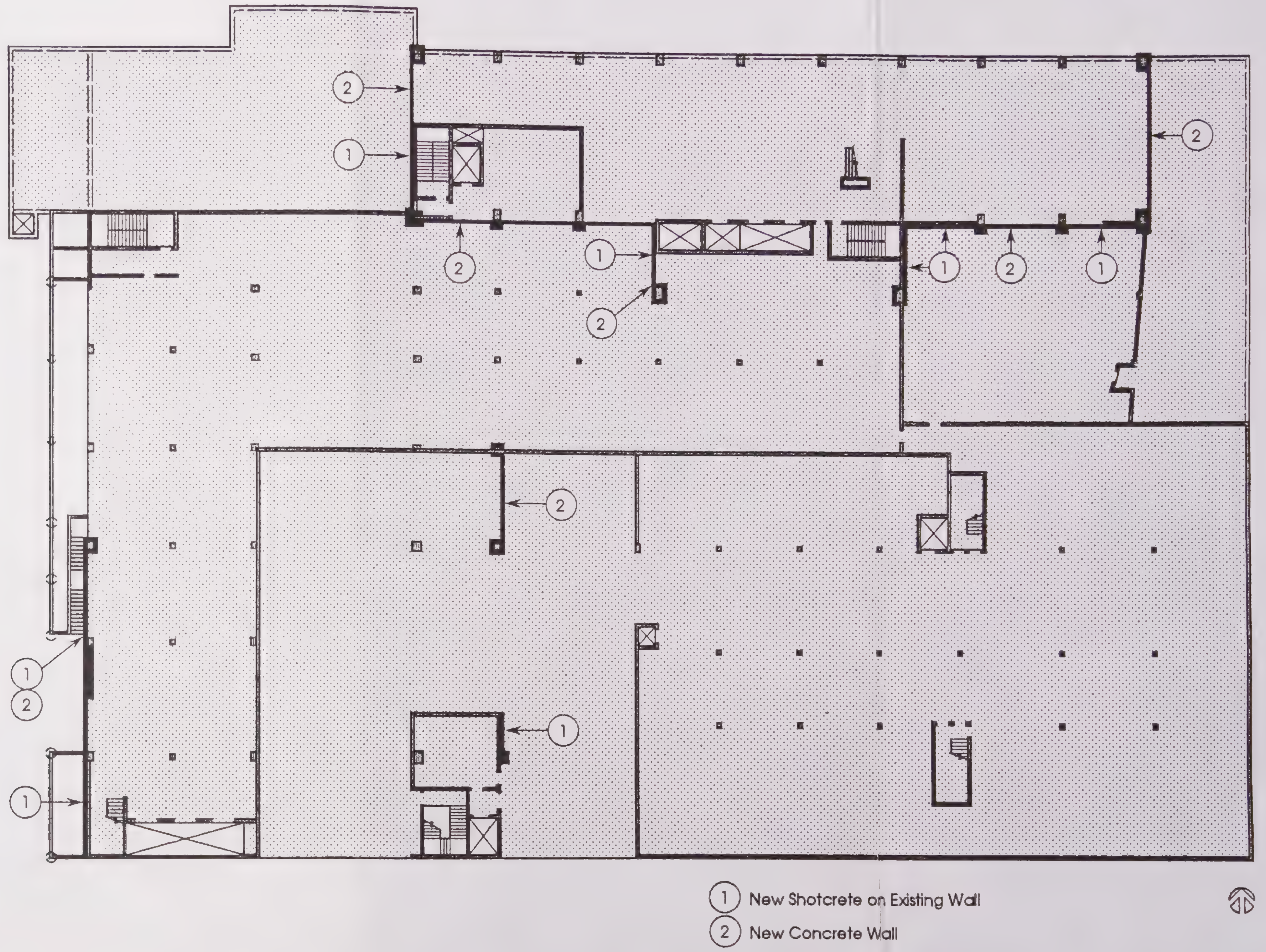
Figure C-4. Retrofit Scheme - 4th Floor Plan (Similar at 5th & 3rd Floors)



1 New Shotcrete on Existing Wall
2 New Concrete Wall
3 New Collector Beam Below
4 Corner Column and Infill Wall - See Figure 26

See Figure 13 for Details Not Noted

Figure C-5. Retrofit Scheme - 2nd Floor Plan



See Figure A-11 for Existing Building Details
See Figure 13 for Details Not Noted

Figure C-6. Retrofit Scheme - First Floor Plan

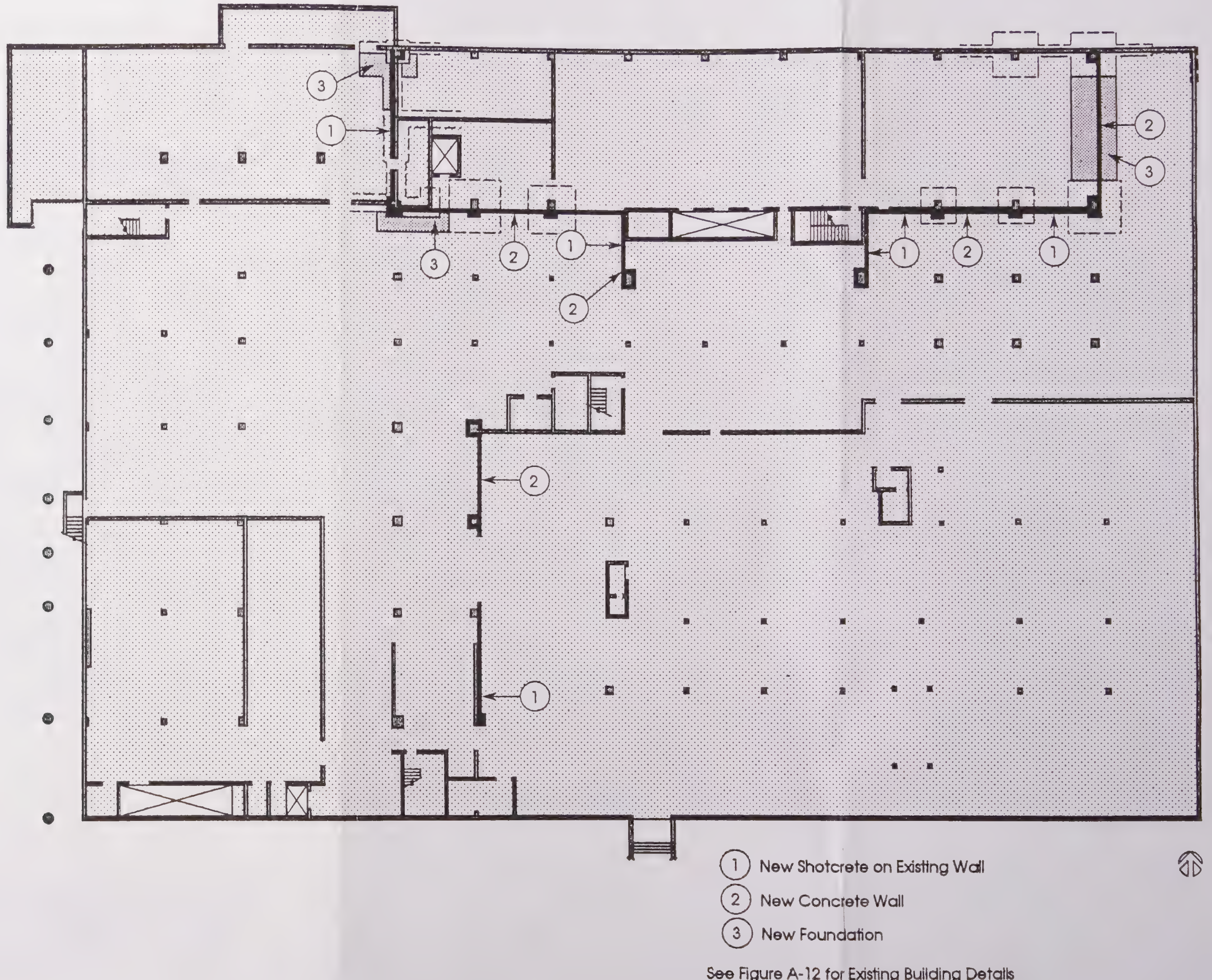


Figure C-7. Retrofit Scheme - Basement Plan

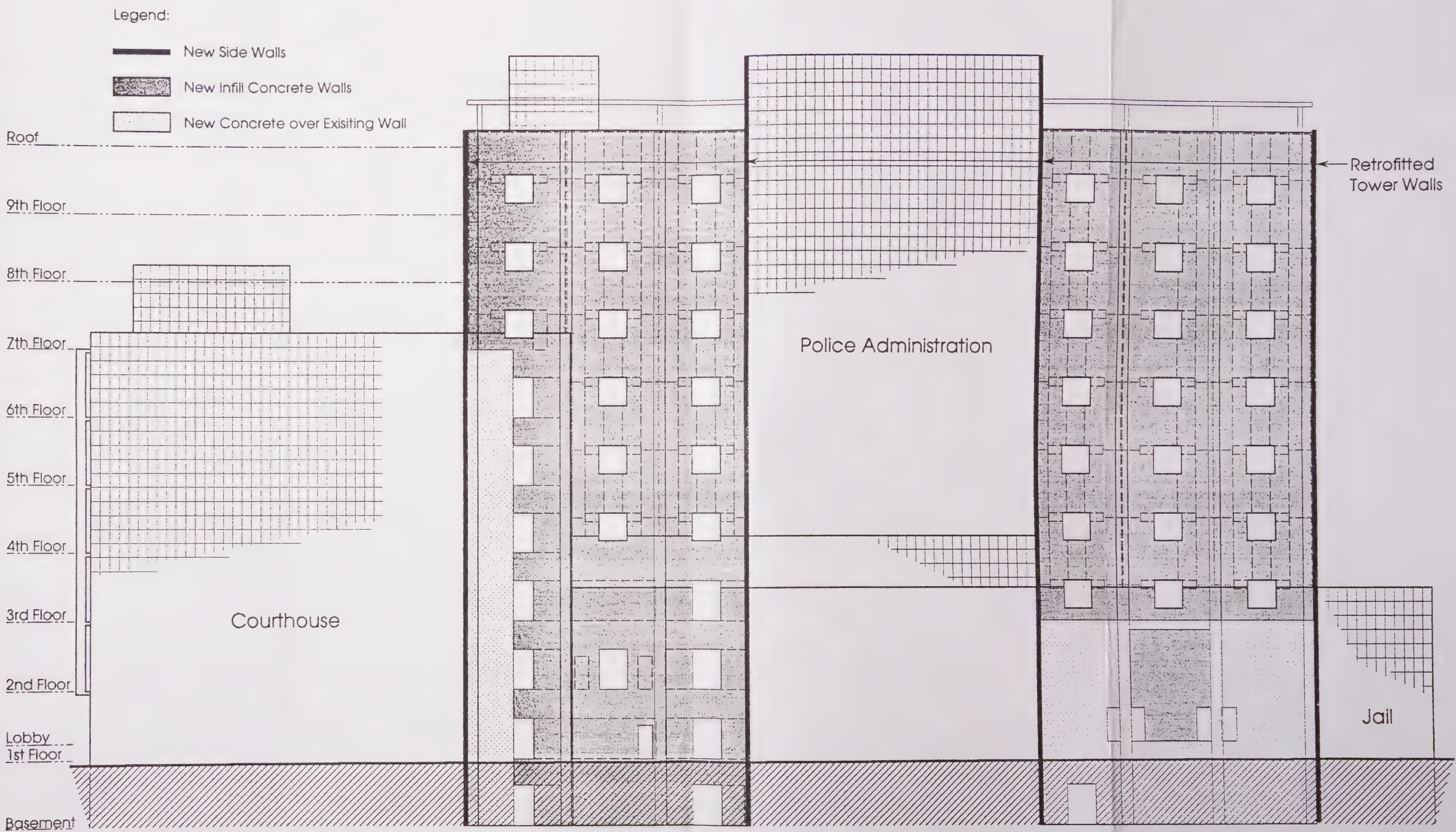


FIGURE C-8. Retrofit Scheme - South Tower Wall Elevation

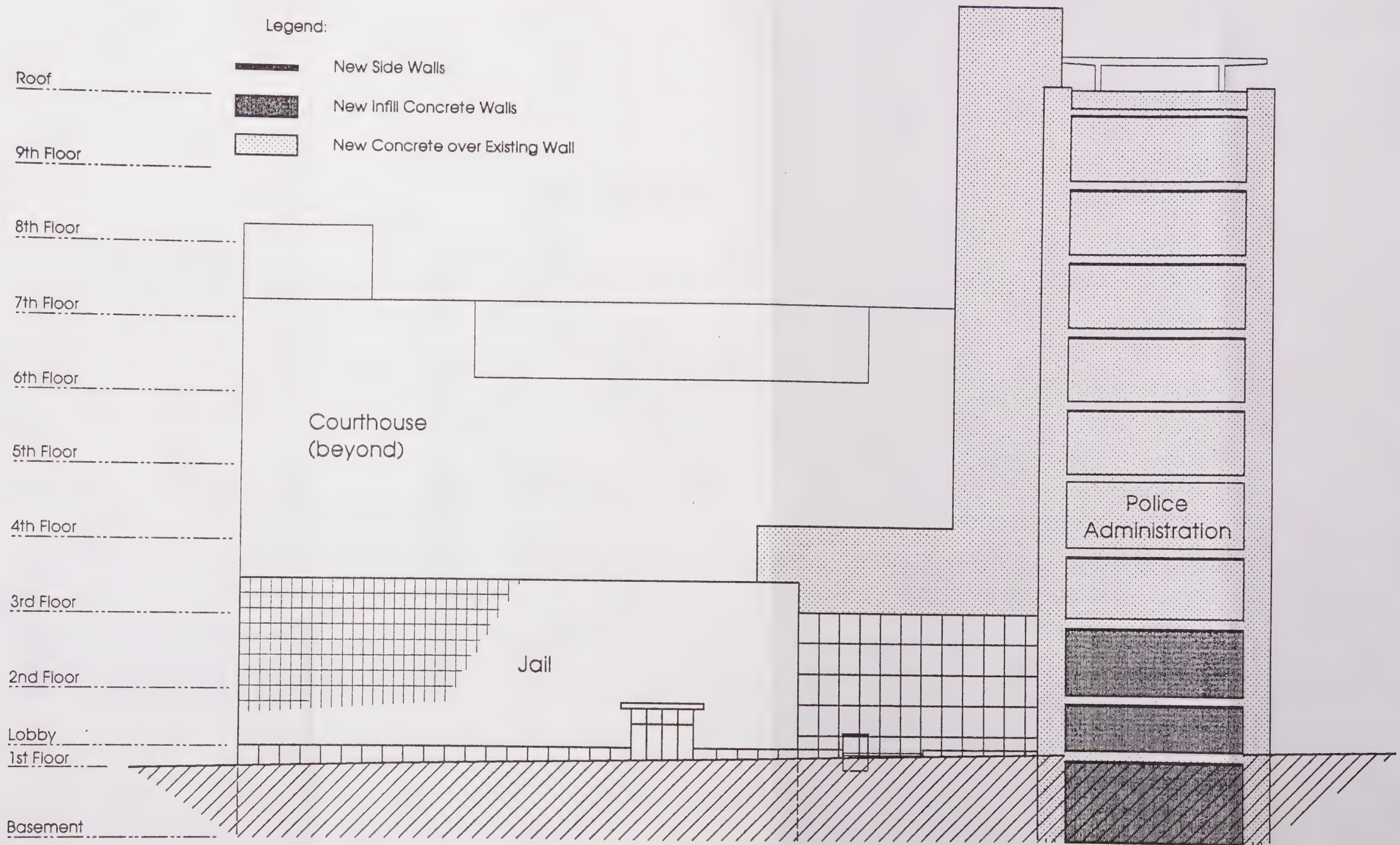


Figure C-9. Retrofit Scheme - East Tower Wall Elevation

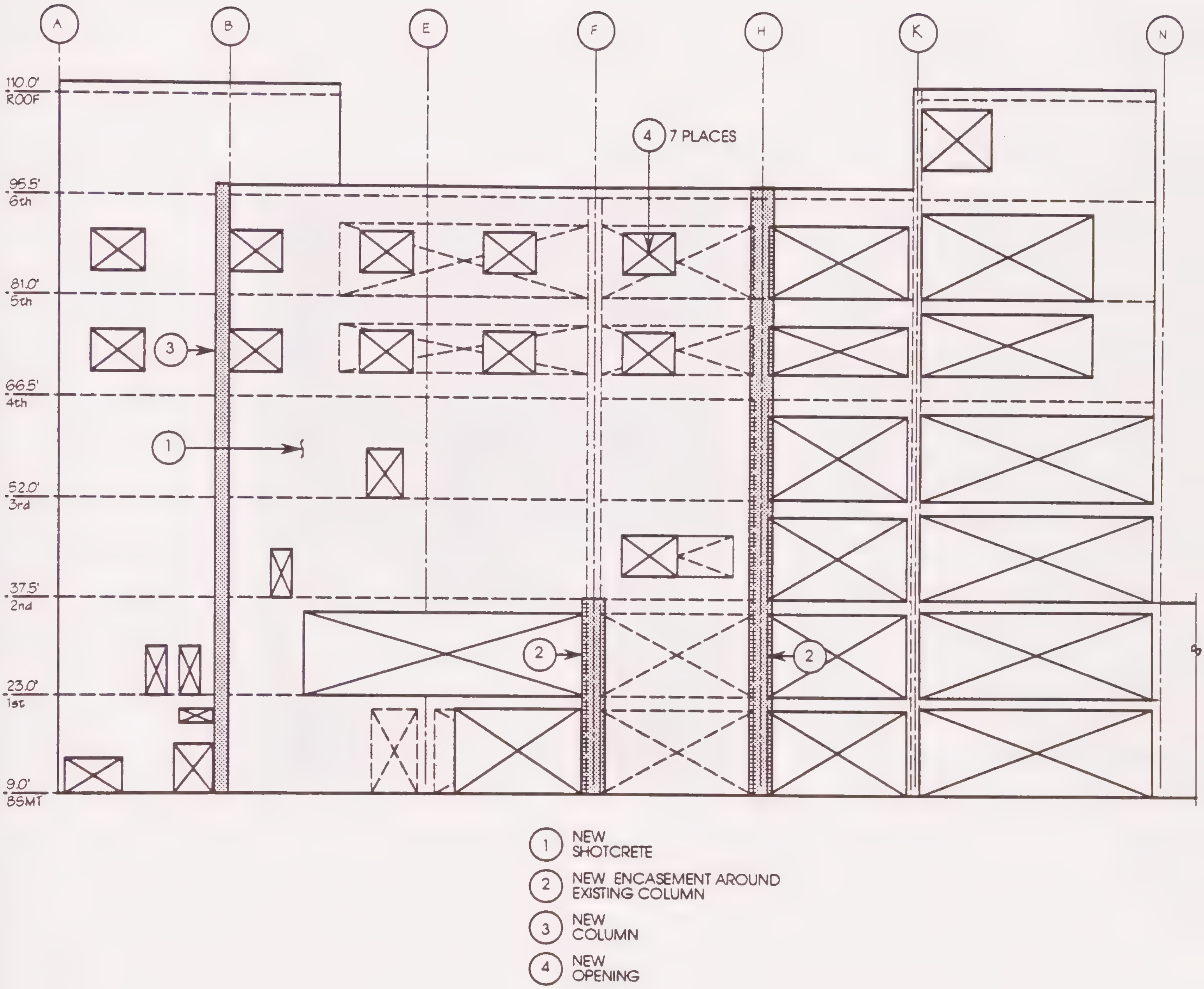


Figure C-10. Retrofit Scheme - East Courthouse Wall Elevation

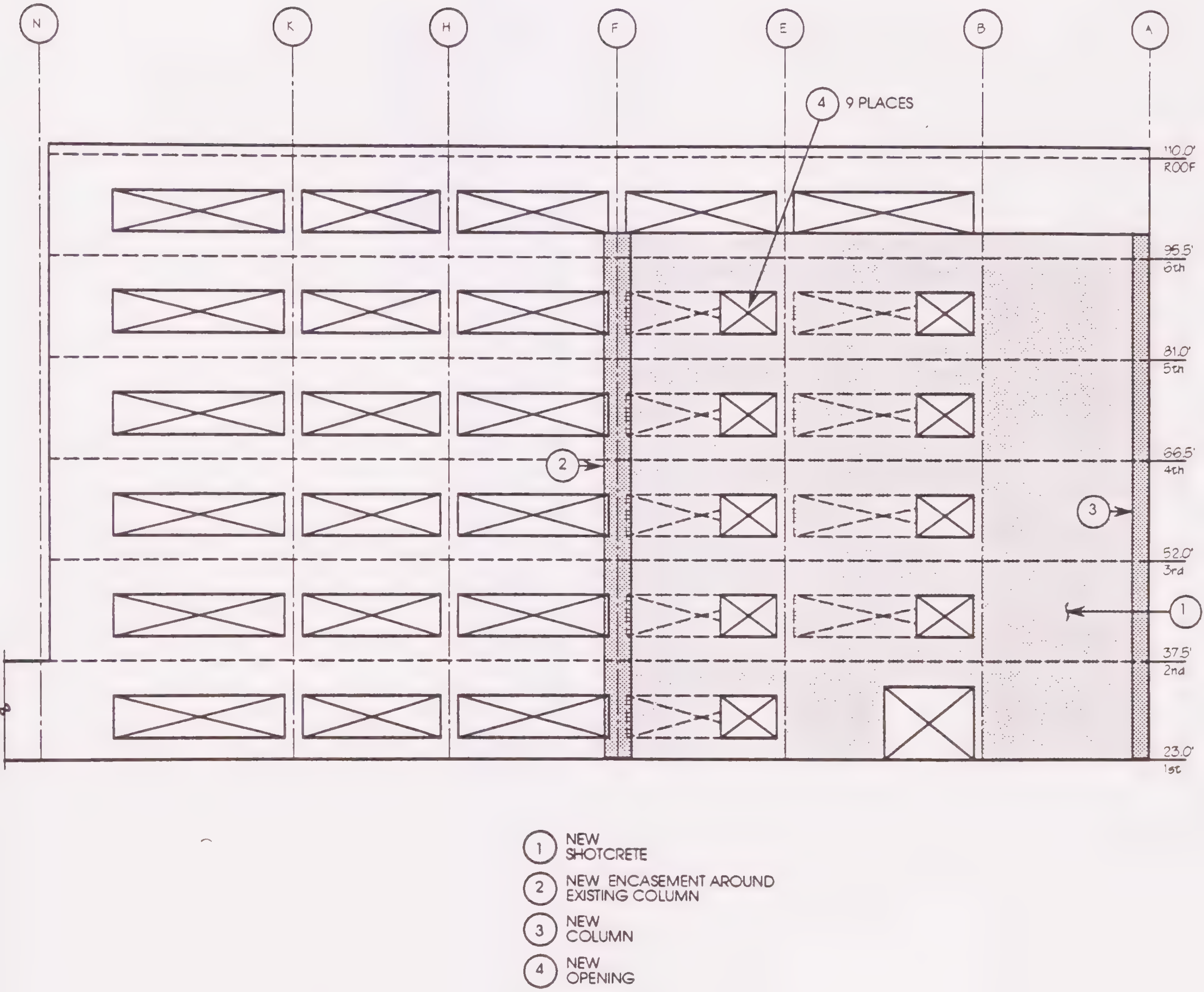


Figure C-11. Retrofit Scheme - West Courthouse Wall Elevation

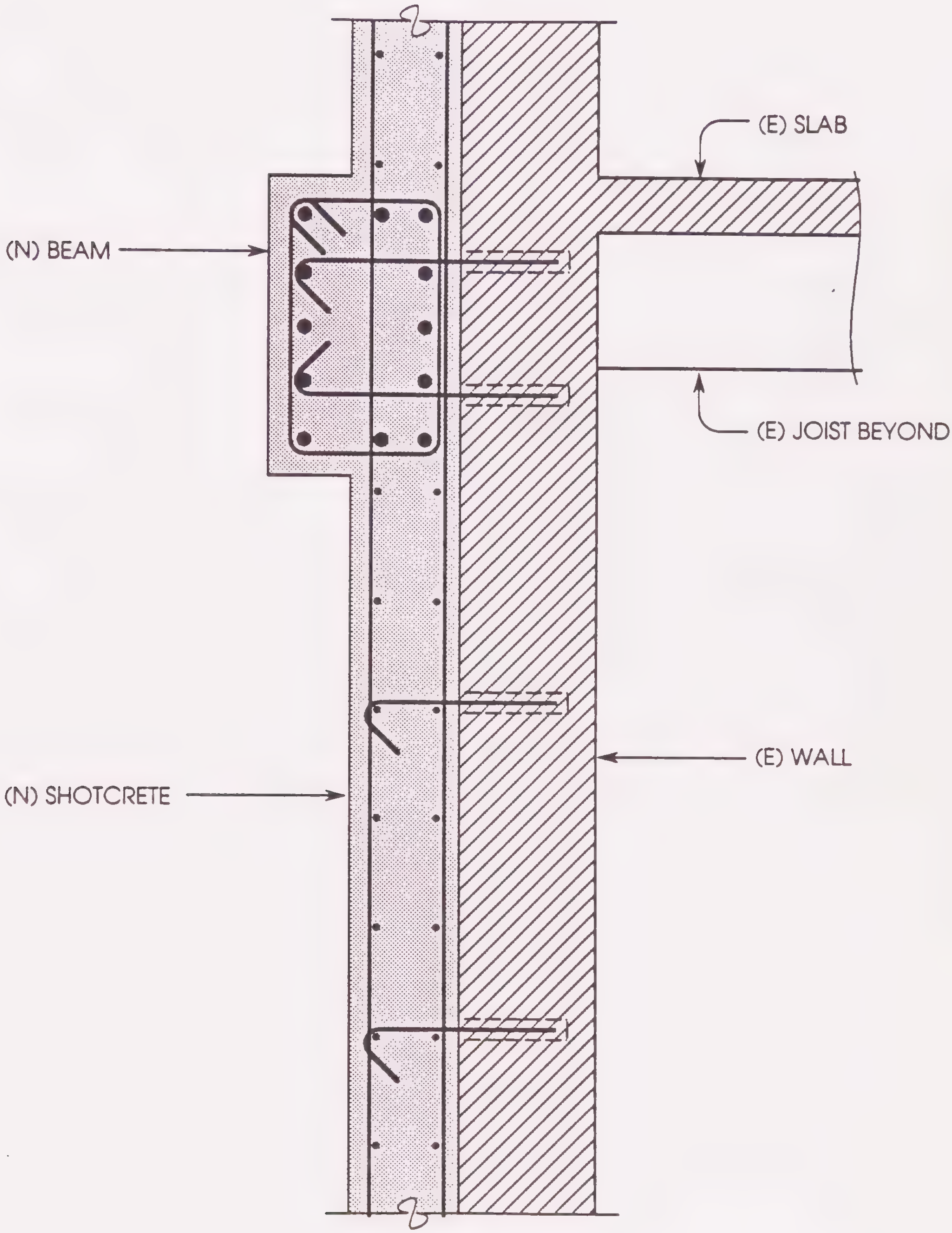


Figure C-12. Retrofit Scheme - Typical Section Through Shotcreted Wall

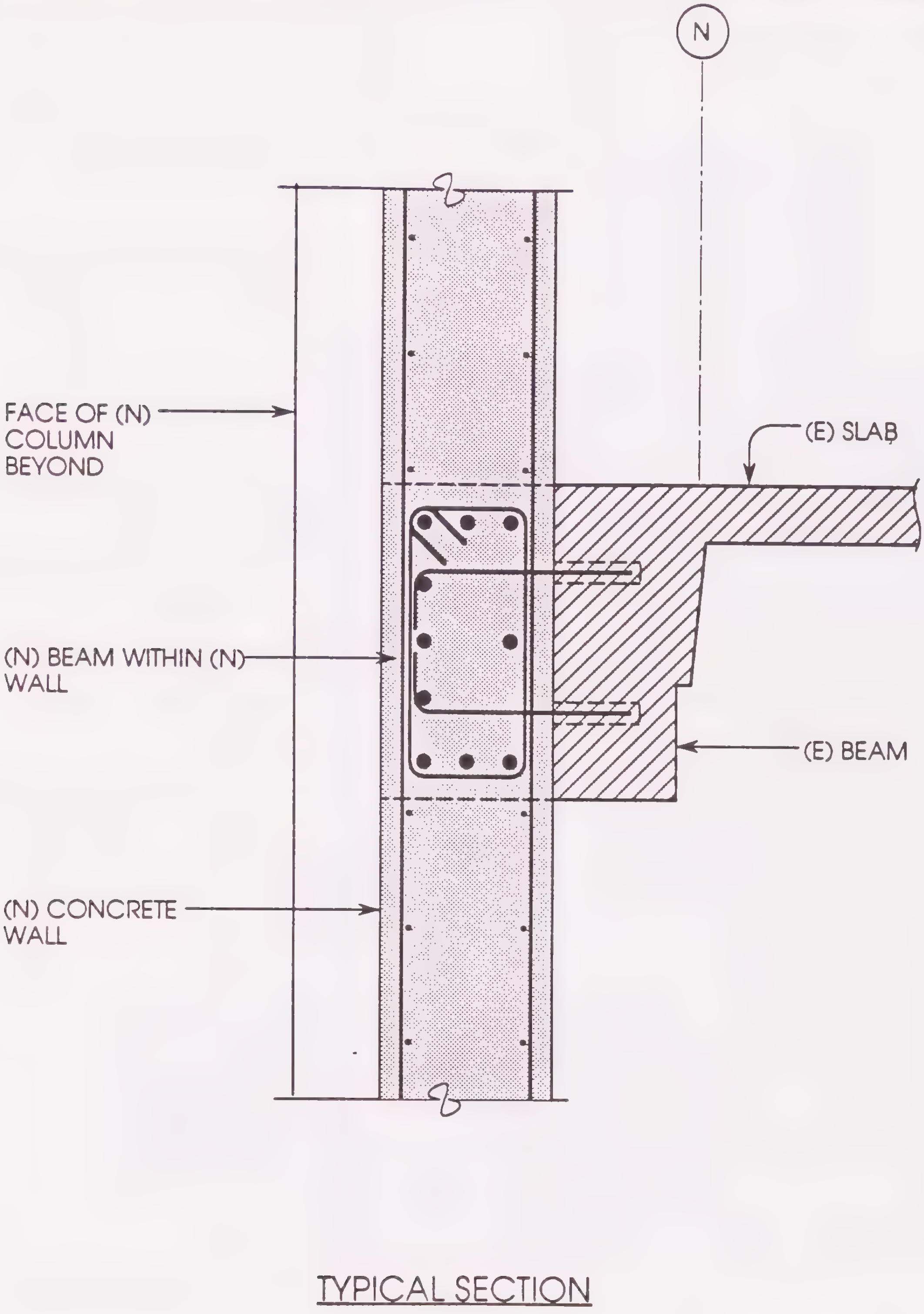


Figure C-13. Retrofit Scheme - Typical Section Through New Wall at Line N

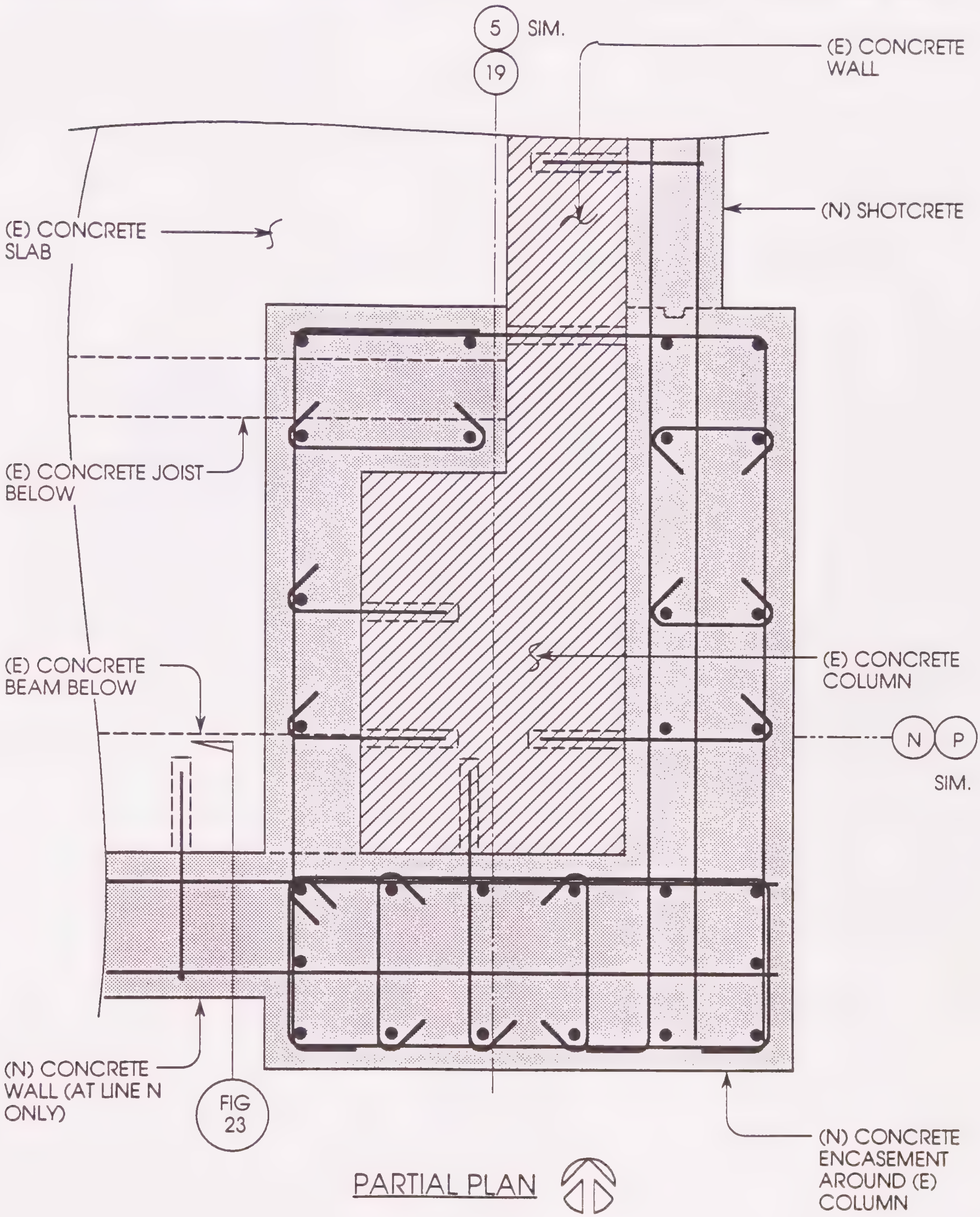


Figure C-14. Retrofit Scheme - Typical Corner Column at Tower

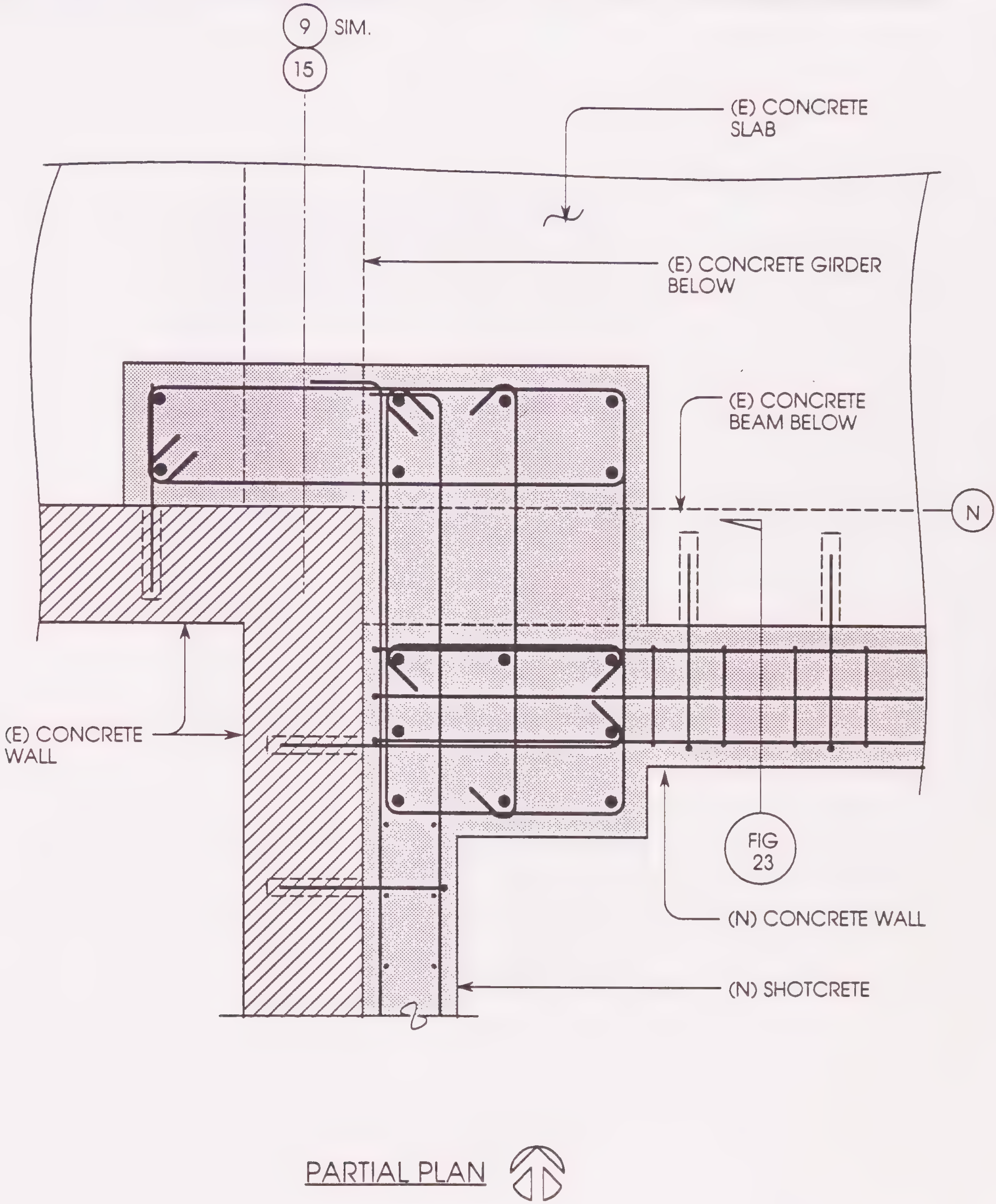


Figure C-15. Retrofit Scheme - New Column at Ends of Elevator Wall

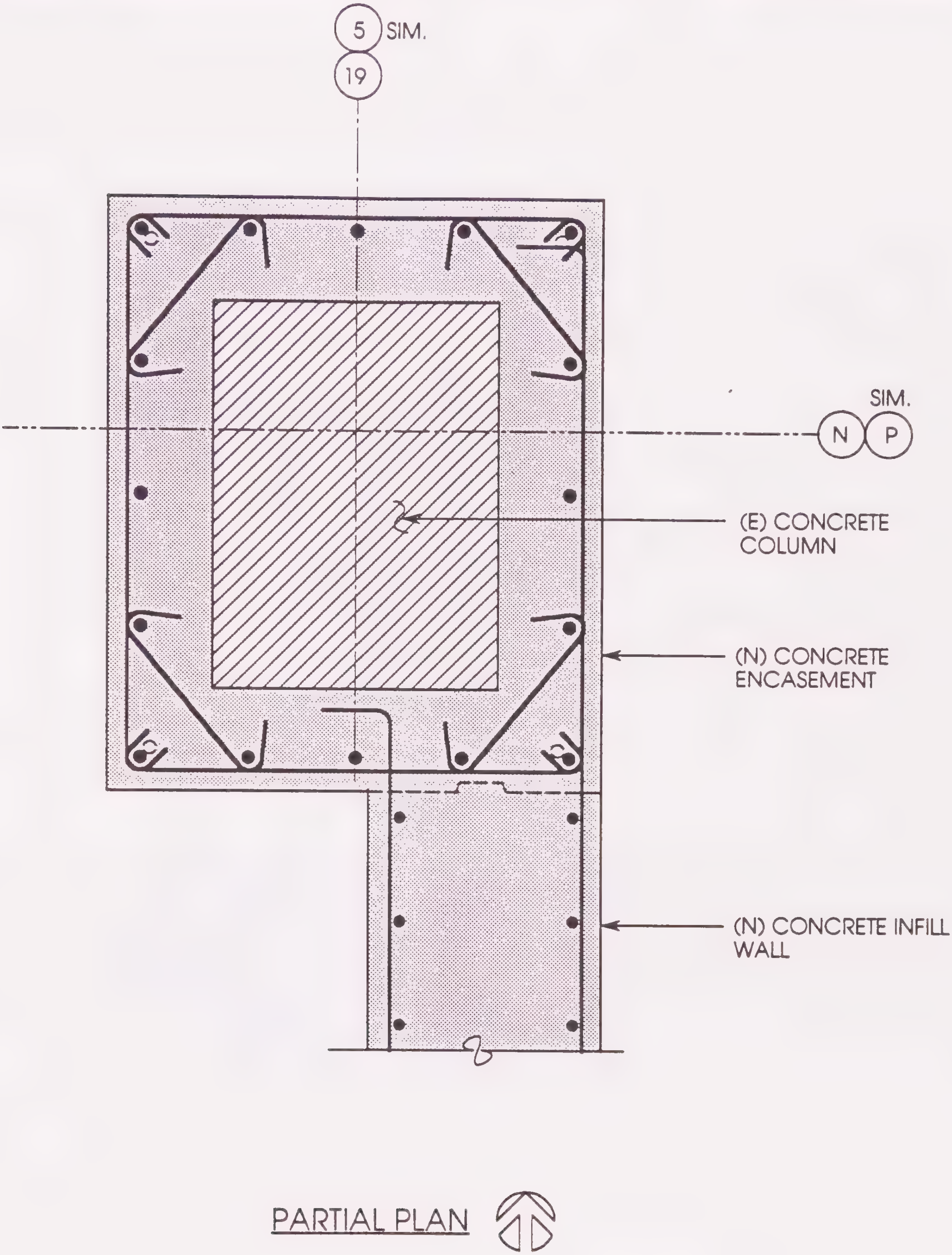


Figure C-16. Retrofit Scheme - Corner Column & Infill Wall Below 3rd Flr.

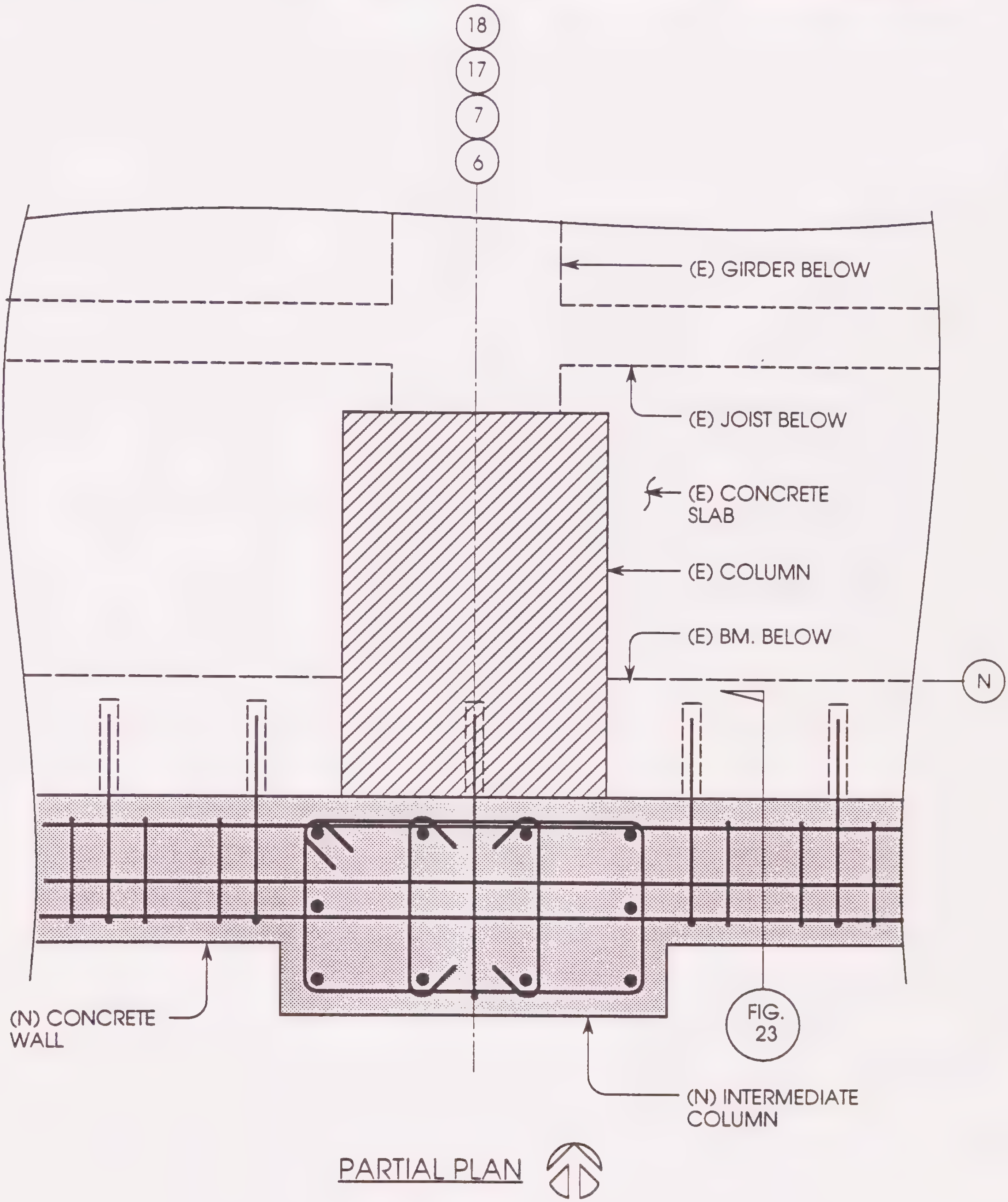


Figure C-17. Retrofit Scheme - Typical Intermediate Column at Tower

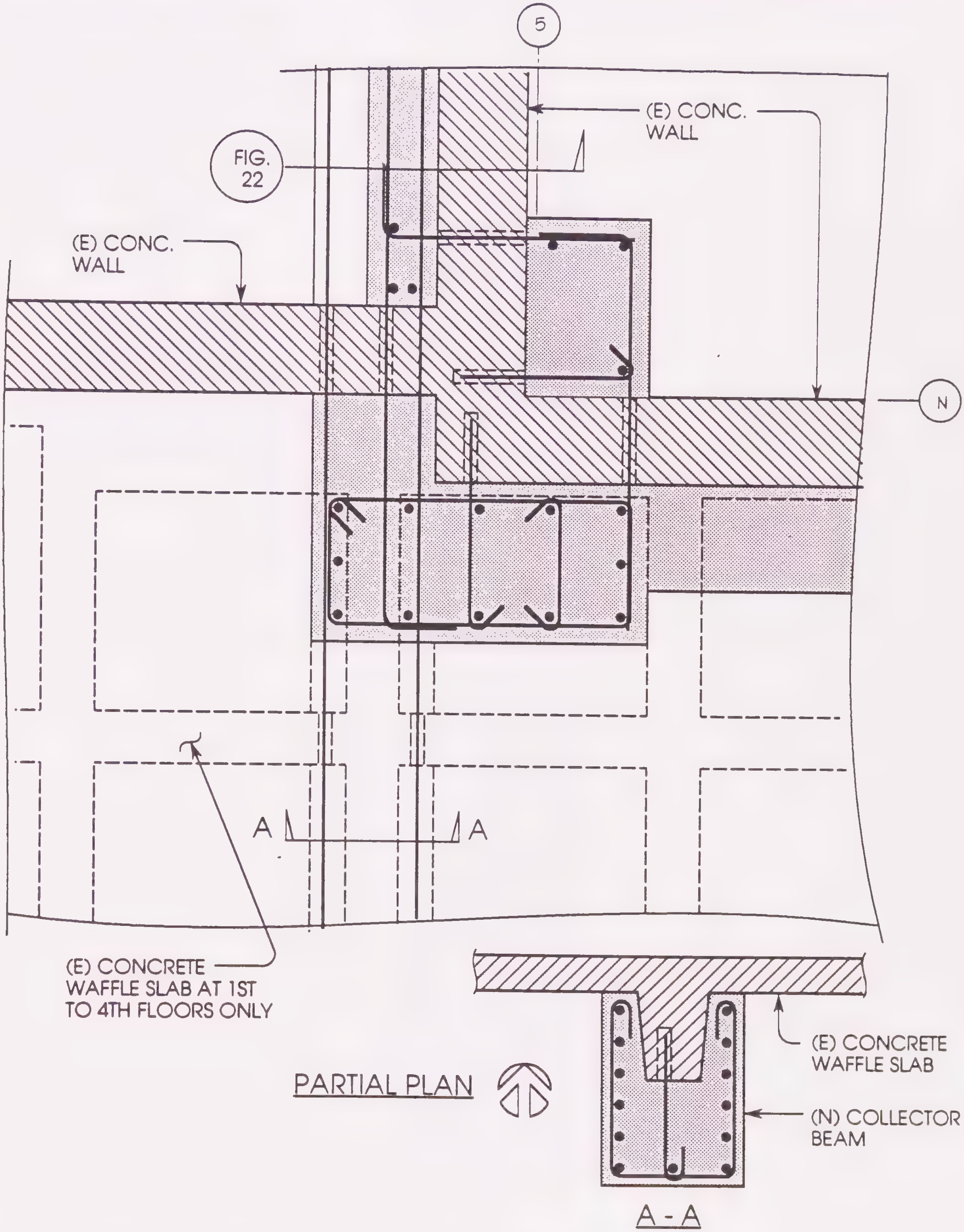


Figure C-18. Retrofit Scheme - Column at Southeast Corner of Tower

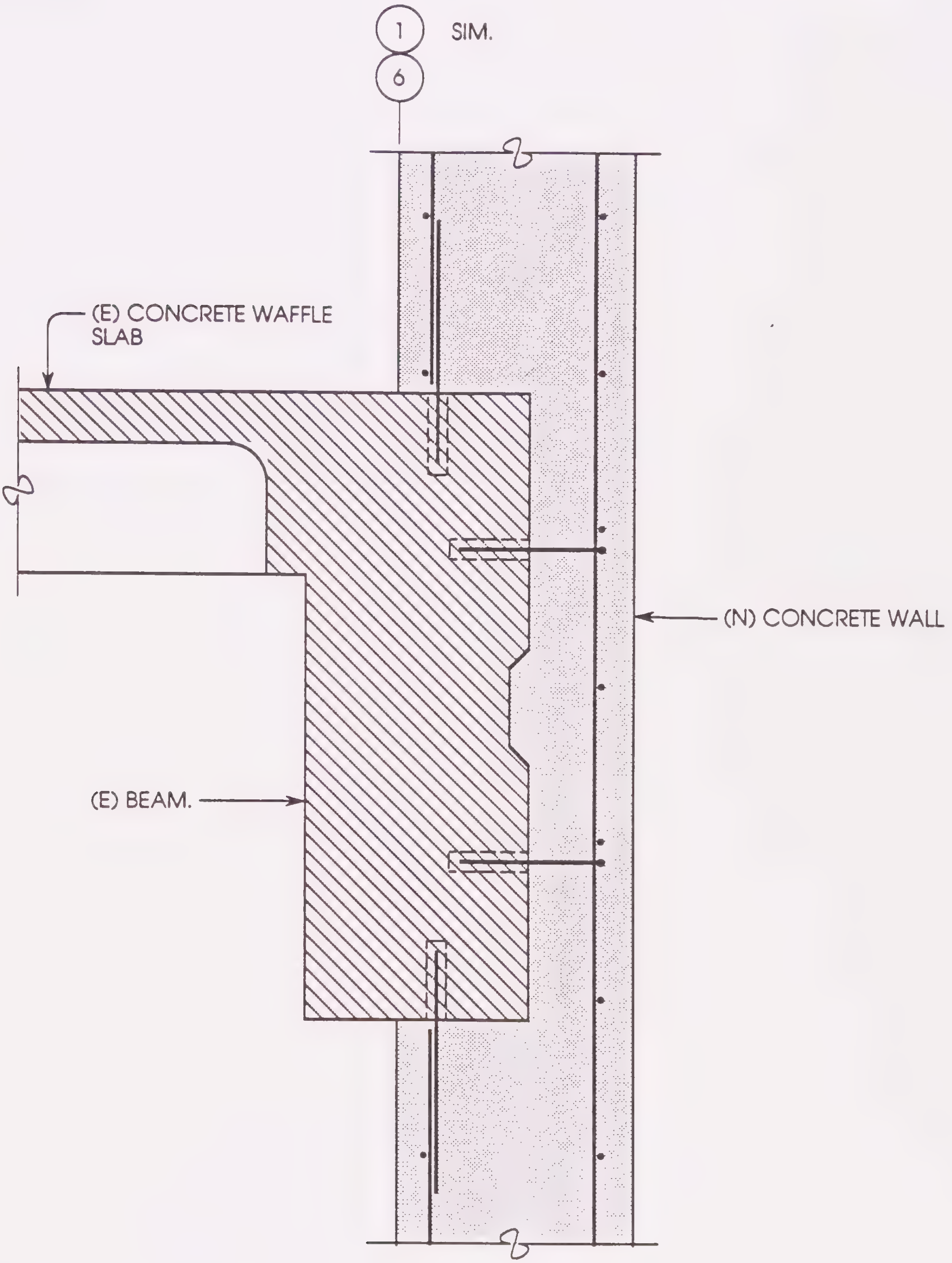


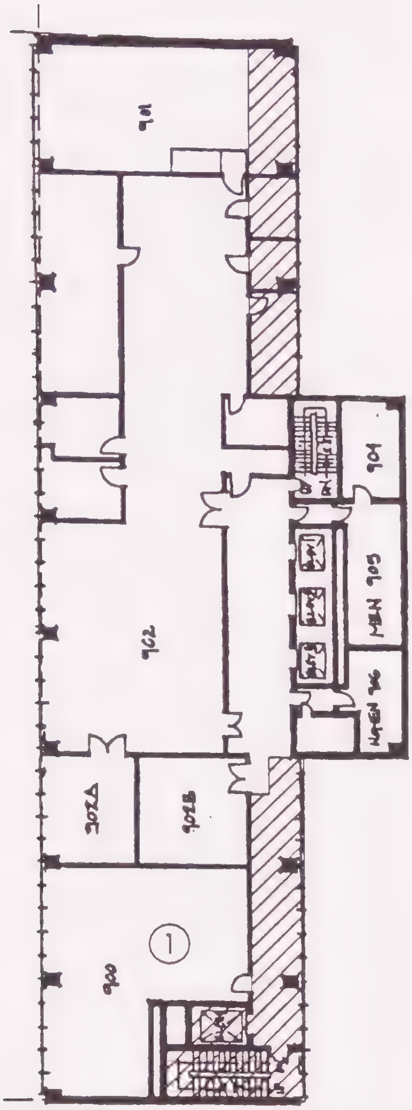
Figure C-19. Retrofit Scheme - Typical Section thru Courthouse Wall

APPENDIX D

This appendix provides a more detailed review of the impacts on the building spaces and users. Items noted are intended to support the cost estimator's review and alert the City of Oakland of area of potentially disruptive work. This review is not intended to be all encompassing or comprehensive.

Where two room numbers are noted, the number in parenthesis is the room number noted on the floor plan within in this report, and the other room number is the room number noted in the construction documents by Confer and Wills.

In Fig. D1 thru D7, areas antipicated to be impactly directly by the construction work have been shown shaded. Where portions of individual offices are impacted, we have assumed that the entire office will not be useable during construction and have shaded those rooms accordingly.



(1) This room may be inaccessible during construction.

General Notes

1. Shaded areas indicate anticipated extent of construction impact during construction.
2. Shaded areas do not reflect potential impact due to mechanical or electrical disruption of service.
3. Room numbers shown on these plans may not match those in the construction documents by Confer and Willis dated 7/29/59. This report is referenced to the Confer and Willis room numbering.
4. Construction access to shaded areas are not considered in this analysis, but will have additional impact to corridors, stairs, elevators, and entries.

Figure D-1. 9th Floor Plan Showing Areas Impacted by Construction

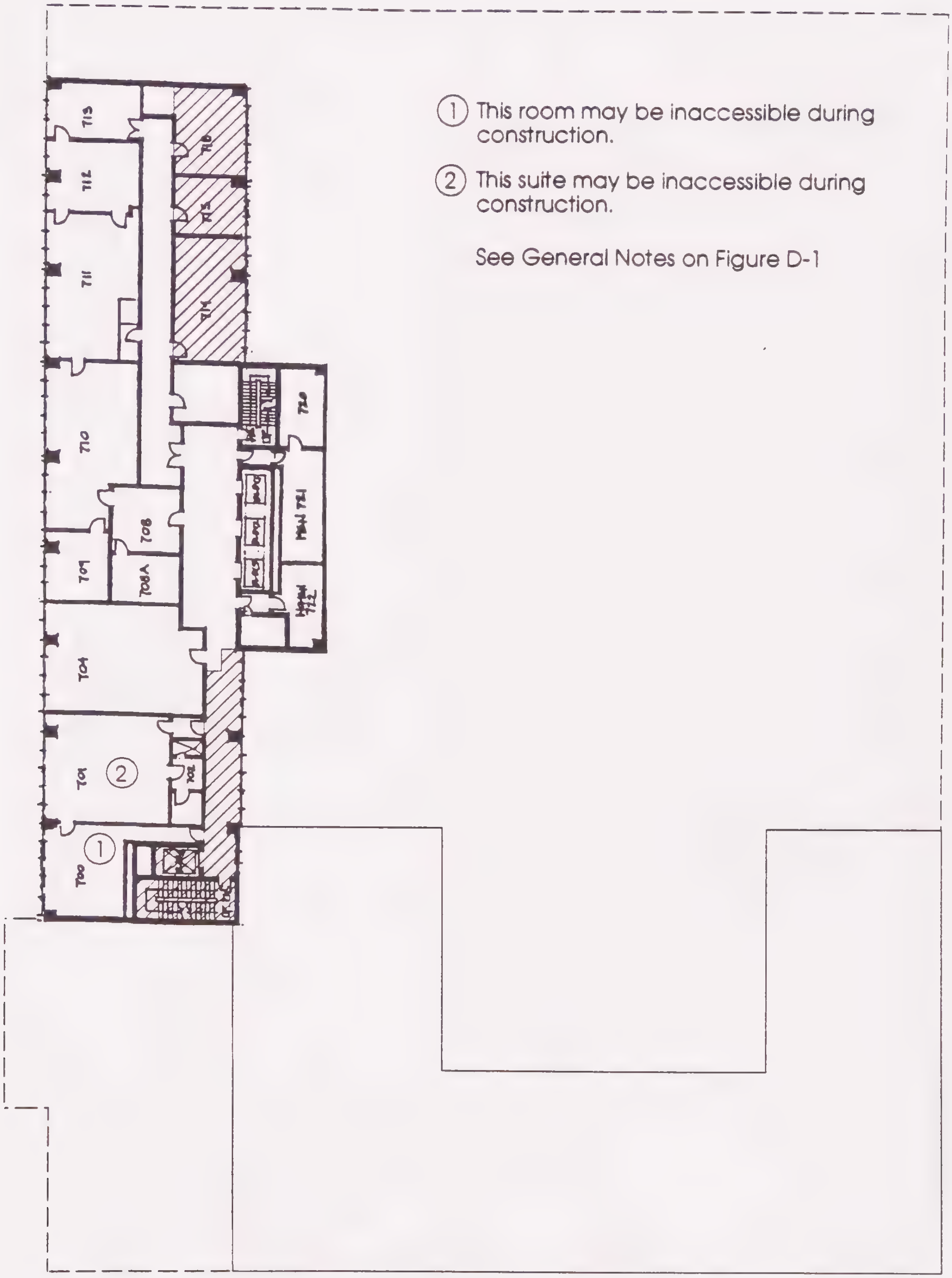


Figure D-2. 7th Floor Plan Showing Areas Impacted by Construction

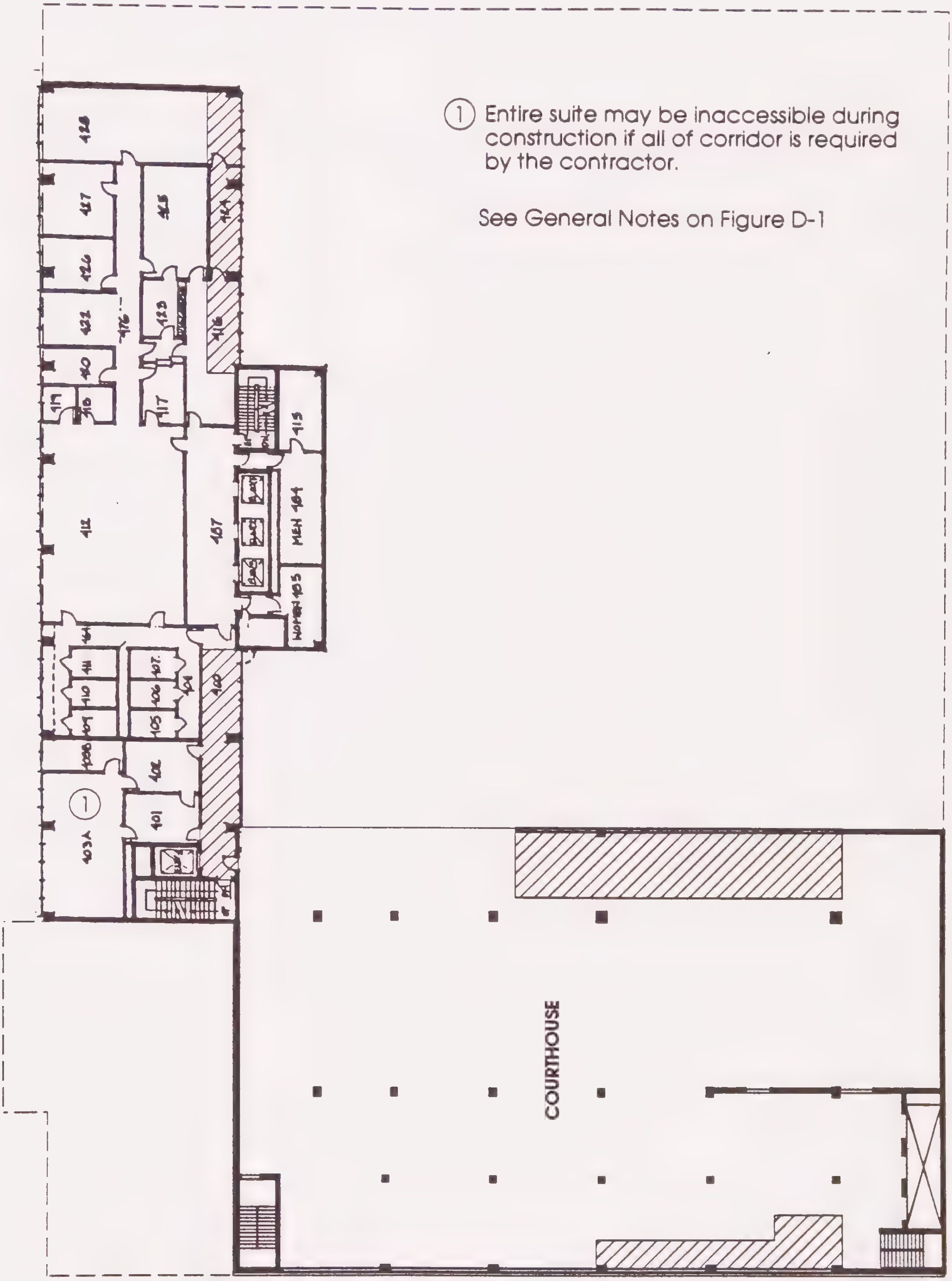


Figure D-3. 4th Floor Plan Showing Areas Impacted by Construction

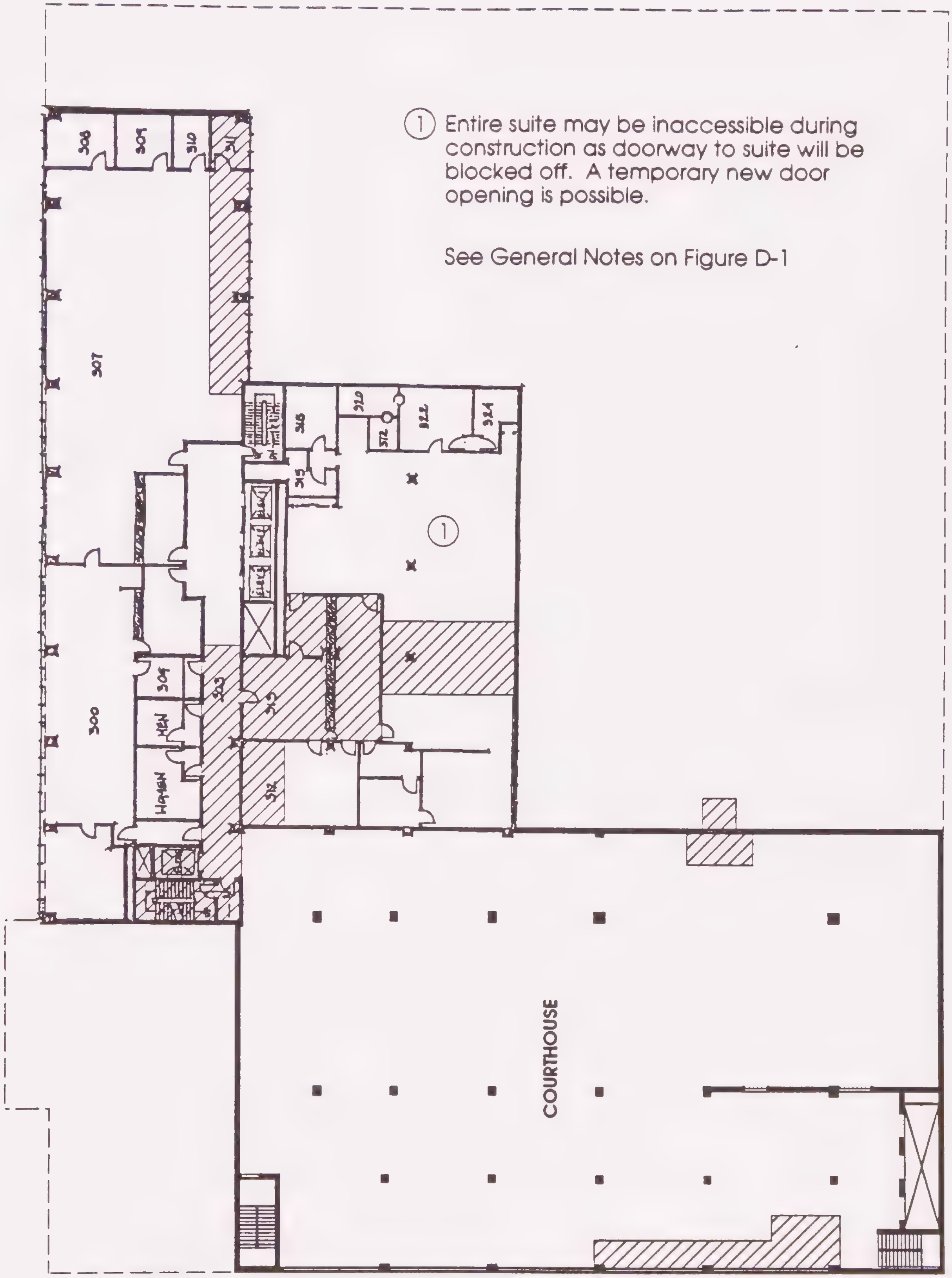


Figure D-4. 3rd Floor Plan Showing Areas Impacted by Construction

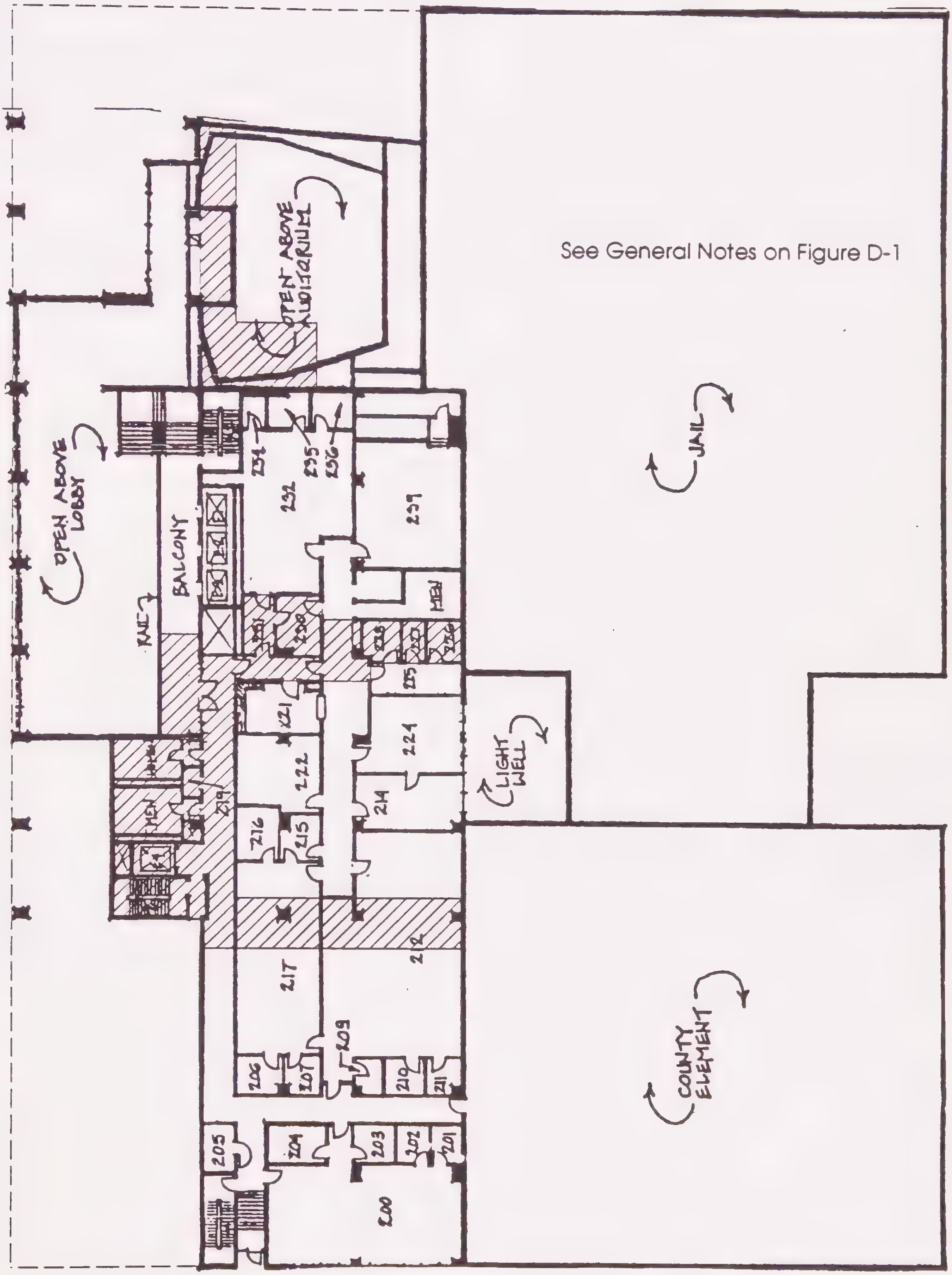


Figure D-5. 2nd Floor Plan Showing Areas Impacted by Construction

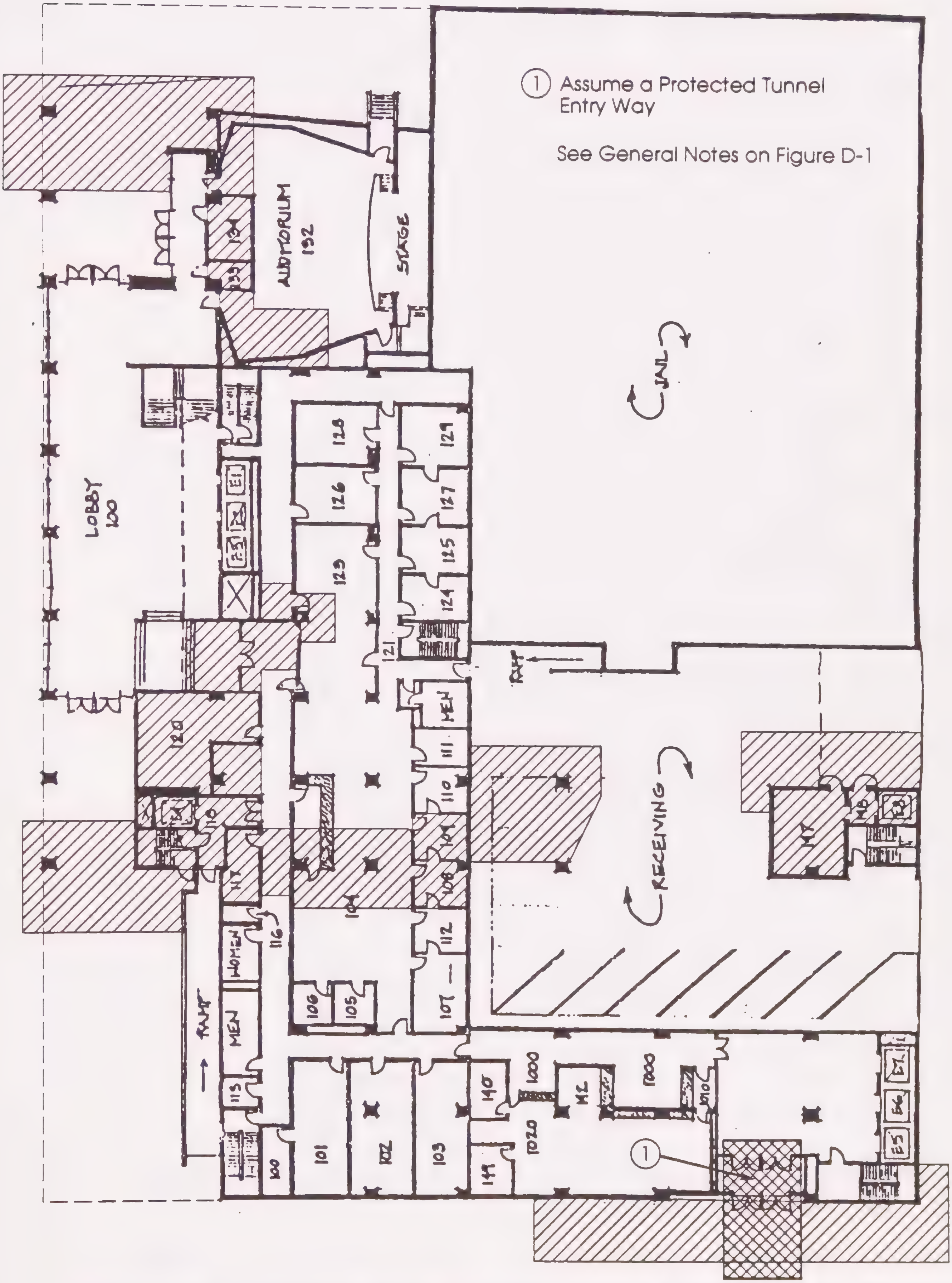


Figure D-6. 1st Floor Plan Showing Areas Impacted by Construction

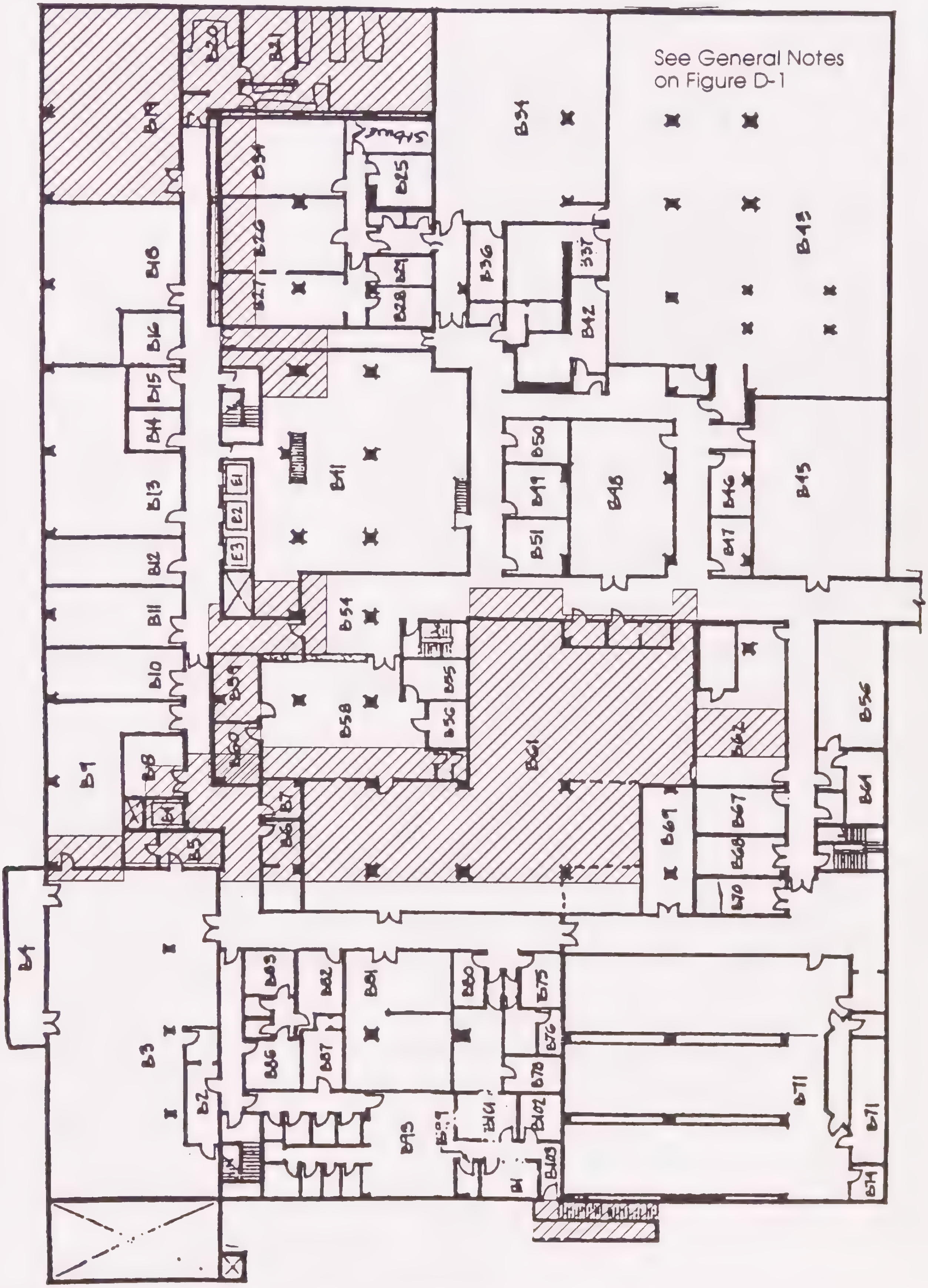
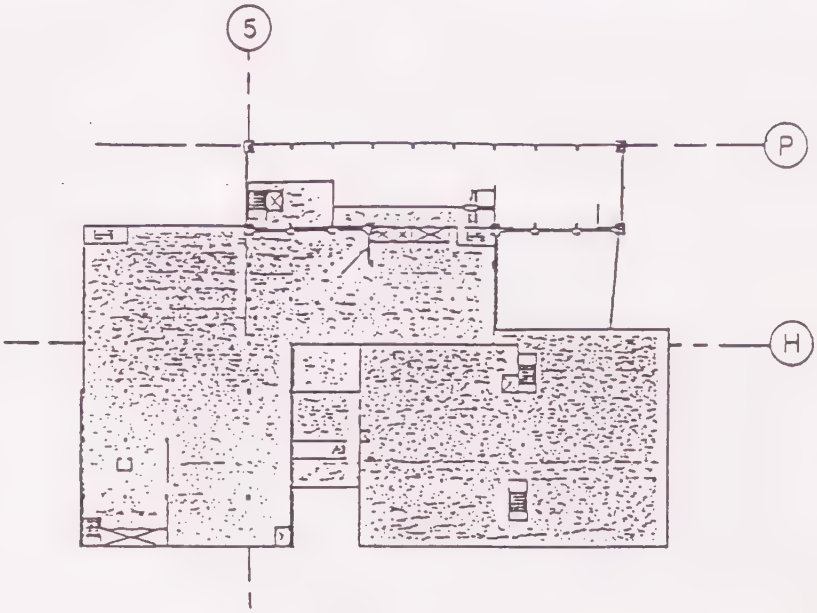


Figure D-7. Basement Plan Showing Areas Impacted by Construction



KEY PLAN

TOWER

Line 5 from line H to P

Basement:
- Room B4 (B3) - mechanical room equipment on or near wall impacted. (see mechanical review)
- Rooms B70, B71, and B107, use impacted.

1st floor:
- Relocate Dry Standpipe and Sprinkler connections

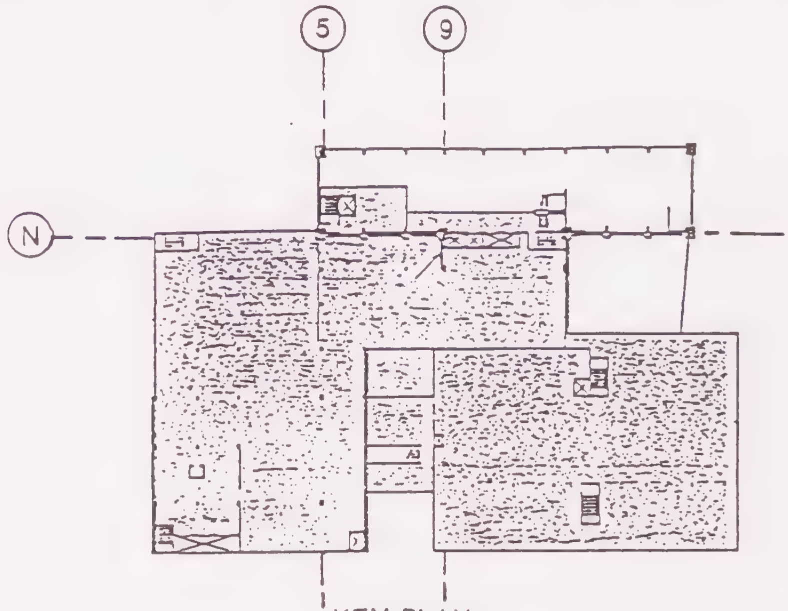
2nd floor:
- none

3rd floor:
- Room 363 corridor impacted
- Room 356 squad locker room access impacted
- Room 358 judge's chamber, and access to, impacted

4th floor:
- Room 418 Civil Marshall usage impact
- Room 455 Judge's Room and Room 423 Civil Courtroom, usage impact

5th floor:
- Offices 581, 579, 576, 574, 571 and Corridor 611 impacted for usage

6th, 7th, 8th, and 9th floors:
- none



Tower

Line N from line 5 to 9

Basement:
- Room B39 (B60) Evidence Room loses 3'-6" in width to 7'-6" relocate cabinet work
- Room B38 (59) Cooler Room loses 3'-6" in width to 7'-6"

1st floor:
- Room 112 Alcove loses 4'-0 ±
- Room 111 (120) Breaks up room into 2 parts, vestibule area
- At Dr. 184, entry storefront, relocate into shearwall

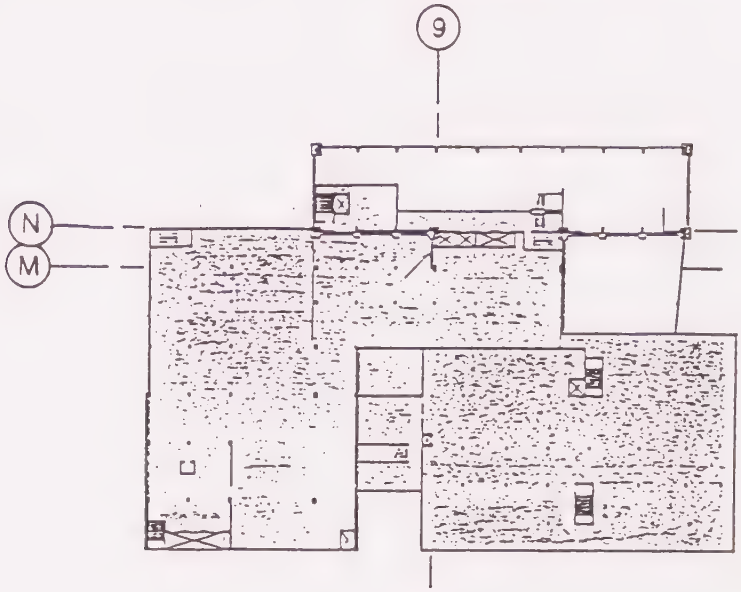
2nd floor:
- Corridor - impacts existing drinking fountain
- Corridor - revise storefront to balcony - main access impacted
- Room 257 (279) - custodian closet narrowed to 3'-6" from 4'-0"
- Exiting to stairs and elevator #4 - access to Men & Women impacted

3rd floor:
- Room 365 (312) Civilian Fingerprint - sink cabinet impacted
- Room 366 (313) storefront entry lost - access impacted
- Access to stairs & elevator #4 impacted

4th floor:
- none

5th floor:
- Room 581 and 582 impacted for usage

6th, 7th, 8th and 9th floors:
- exiting impacted



KEY PLAN

Tower

Line 9 from line M to N

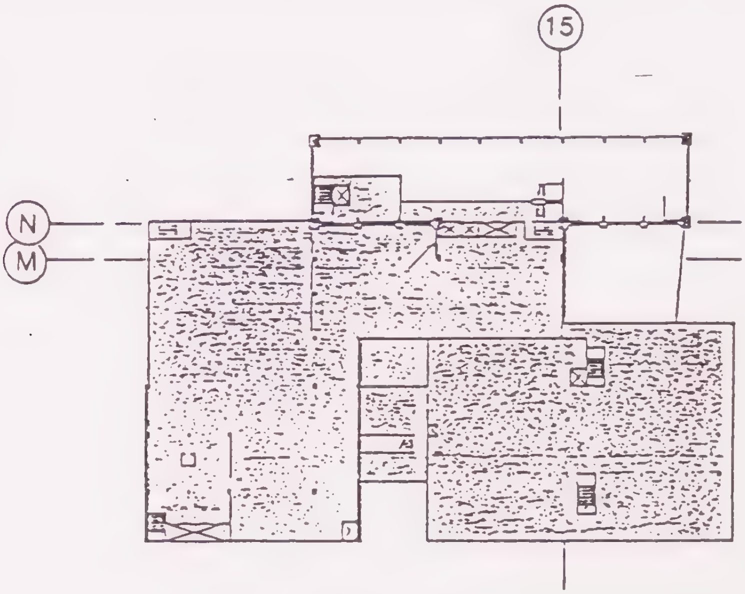
Basement:
- Impact on duct space (see mechanical review)

1st floor:
- none

2nd floor:
- none

3rd floor:
- Rework case work

4th, 5th, 6th, 7th, 8th, 9th floors:
- none



KEY PLAN

Tower

Line 15 from line M to N

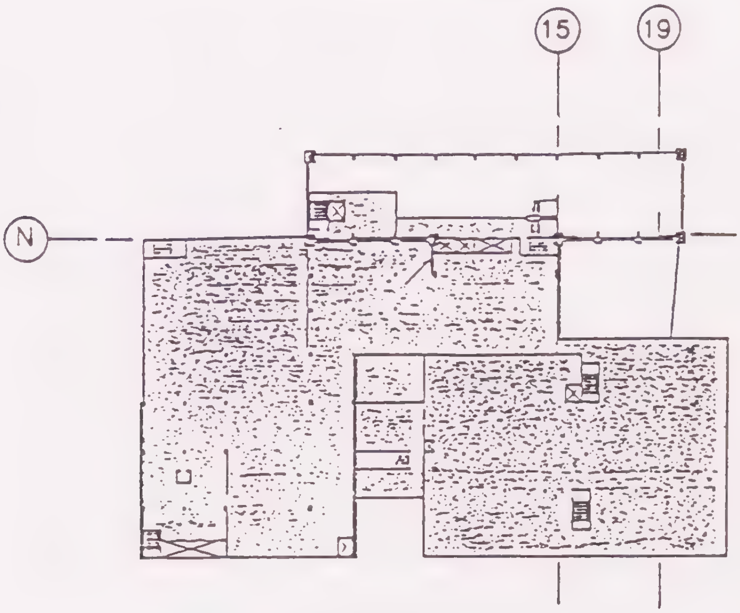
Basement:
- Impact on "bus duct" (see electrical review)

1st floor:
- Room 136 (132) Auditorium - duct space impacted - check extent of ducts
- Room 136 (132) Auditorium - tear down finishes in auditorium to access wall for shotcrete.

2nd floor:
- (same as 1st floor)
- Relocate roof hatch and ladder

3rd floor:
- Roof area - impacts ducts from below (see mechanical review)

4th, 5th, 6th, 7th, 8th, 9th floors:
- none



KEY PLAN

Tower

Line N from line 15 to 19

Basement:
- In locker rooms, may lose 4 lockers

1st floor:
- Auditorium - between 15 to 17, can wall narrow to 10"
- Auditorium - projection booth impacted severely. Review use with users
- Auditorium - could lose a few seats
- Auditorium closed during construction

2nd floor:
- (same as 1st floor)

3rd floor:
- Room 394 (311) - narrows photocopy room to 6'-0

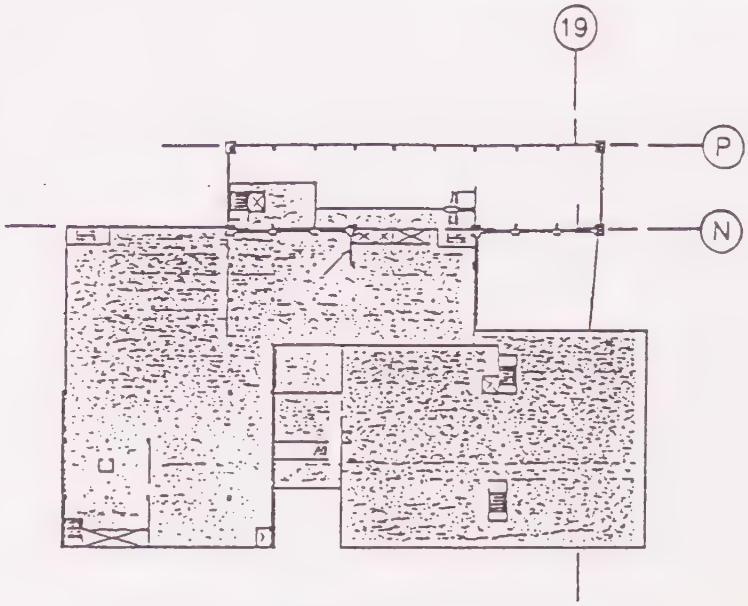
4th and 5th floors:
- none

6th floor:
- Room 669 (617) and 668 (621) - casework impacted

7th floor:
- none, except usage

8th floor:
- Room 820 lockers lost, may not have enough room left

9th floor:
- Current plans not available. Impact will be noise related to demo of roof topping slab.



KEY PLAN

Tower

Line 19 from line N to P

Basement:

- Room B17 (B19) - Inactive Records - splits room in half. Space may require redesign of the office/conference room layout.

1st floor:

- Exterior lobby plaza - need opening in wall to link separated plaza areas

2nd floor:

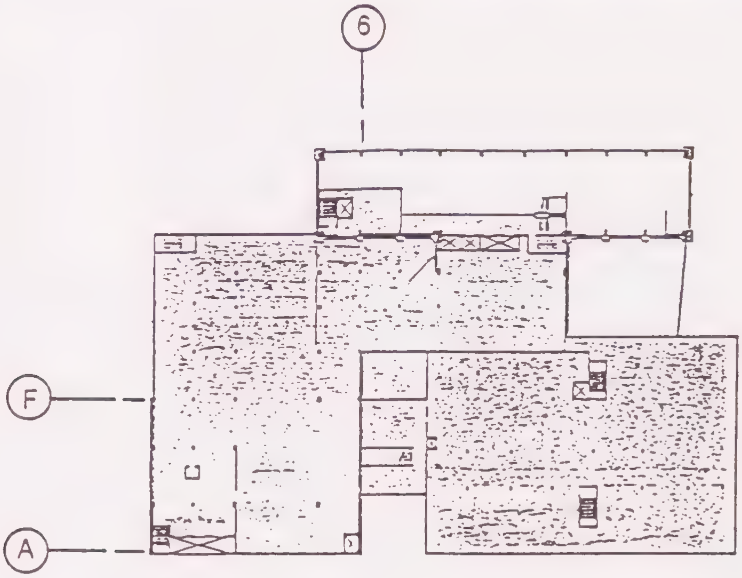
- none

3rd floor:

- none

4th, 5th, 6th, 7th, 8th and 9th floors:

- none



KEY PLAN

Court Building

Line 6 between line F and A shear wall

Basement:
- Room B71 (B61) shearwall may disrupt shelving unit storage.
- Property and Evidence Storage is high security area. Therefore unit must relocate during construction

1st floor:
- Between line A & E, rework width of gates (2 ea)
- Between line C & G, shear wall may interfere with turnaround requirements for vehicles.

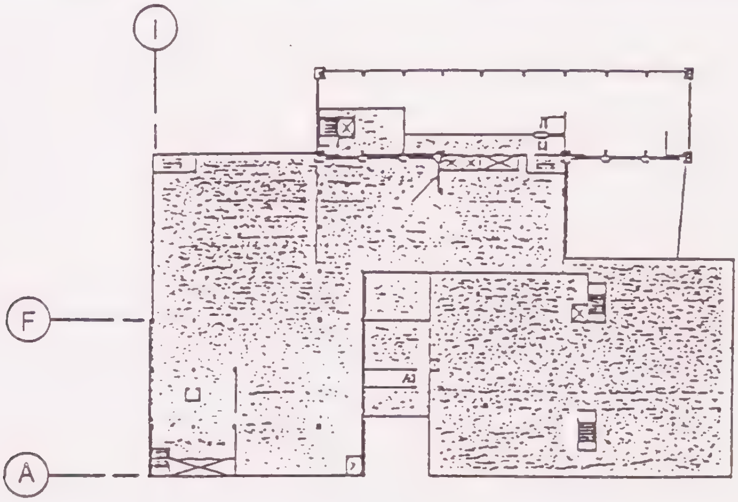
2nd floor:
- Room J297 Women's Holding - water closet may need to be relocated. Room not useable during construction
- Room J295 Men's Holding - water closet may need to be relocated. Room not useable during construction
- Re-establish 2" expansion joint
- Room J293 move wall over 10" to maintain hall width.
- Roof patching required.

3rd floor:
- 2" expansion joint relocation / roof patching required.

4th floor:
- Room 441 and 444 toilet and vestibule needs to be reworked to allow access

5th floor:
- Shear wall may narrow offices 563, 562, 559 to 7' width

6th floor:
- no impact



KEY PLAN

Court Building

Line 1 between F & A shearwall

Basement:

- Impacts ext. stairs - move stair west 10"
- Special Services would need to relocate as assess to one exit lost during construction

1st floor:

- Assume entrance between line B - E maintained
- Re-landscape planter areas line A to F.

2nd thru 6th floors:

- Remove sun screen
- Women's toilet closed during construction - suggest to use Men's on every other floor
- Office space within 6 to 8 feet of existing window locations require relocation.

OVERVIEW OF MECHANICAL SYSTEM

Tower:

1. Supply air fan on roof supplies air to floors 1 - 9
2. Return air fan in basement pulls return air through the duct shaft plenum along line 9N
3. Basement and Toilet Exhaust Fans located on roof and ducts through line 9N duct shaft plenum
4. 6th floor has separate fan to exhaust 100% return air
5. Floors 1 - 9 are supplemented by radiant heating and cooling coil system mounted in grid-like matter in the suspended ceiling system.
6. Two supply air fans in the basement feed a directed heating and cooling system
7. Chiller and Boiler for entire complex in the basement

Jail:

1. Heating and cooling is supplied from the supply fan in the Tower basement (see item 6 above)

Court Building:

1. Supply air fan system on root supplies air to floors 1 - 6
2. Return air is ducted through the Tower duct shaft plenum
3. Exhaust fans for corridor and toilets on the roof of court building
4. A radiant heating/cooling system also used. (See Item 5 above)

GLOBAL MECHANICAL REVIEW

Tower: Duct shaft at 9 line

1. Supply is at roof top penthouse
2. Supply in shaft to feed floors below
3. Supply in floor 9 to I4 not impacted
4. Floor 3 - at line 9M col. supply could be impacted affecting rooms 365, 366, 367, and 368
5. Floor 2 - at line 9M col. supply could be impacted affecting supply to entire floor
6. Floor 1 - shear wall at line 9 will affect supply to all rooms from line 1 to 15
7. Duct don't go to basement level

Tower: Duct shaft at 9 line

1. Shaft is used as return air plenum for all floors except floor 6
2. Floor 6 return air is through roof top unit on court room building roof. Impacted by shearwall along line N

Tower: Duct shaft along line 15

1. Two supply fans with main high pressure feeder ducts going through shearwall location. All of the basement level and all of the jail is impacted
2. Duct at line 15N feeding auditorium are impacted by shearwall

Tower: Along line N east side

1. Ducts in projection room impacted
2. Ducts and mixing box feeding locker room impacted

Tower: Along line 19

1. Ducts and mixing box impacted in basement room B17 and B18

Tower: Along line 5

1. Floor 6 - collectors may impact supply fan operation during construction
2. Floor 5 - collectors may impact ducts, especially return air duct which affects 2/3 of court building rooms on this floor
3. Floor 4 - main feeder to rooms between line 5 - 6 impacted. Half of courtroom also impacted
4. Floor 3 - same impact as floor 4 - return air for entire court building floor impacted
5. Floor 2 - return air for entire court building floor impacted - supply between lines 5 - 6 impacted
6. Floor 1 - supply and return ducts west of line 5 impacted
7. Basement - at collectors, main branch of return air is impacted affecting most of court building basement rooms. A number of supply ducts affecting localized areas

Tower: Along line N west side

1. Floor 6 - main duct for return air for 6th floor tower impacted affecting all rooms
2. Floor 5 - main duct for return air for 5th floor court building impacted affecting all rooms
3. Floor 4 - same as 5
4. Floor 3 - same as 5
5. Floor 2 - Transfer grilles to toilet rooms impacted and supply main to court building west side impacted
6. Floor 1 - room 111 and 112 impacted only
7. Basement - mix box and main duct supply for local area impacted (B37, B34, B35, B39 and B38)

Courtroom Building: Along line 6

1. Floor 2 - rooms 277 and 278 impacted
2. Basement - main ducts impacted - basement of court building affected (most rooms)

Typical all floors except basement

1. Ceiling have a grid of radiant heating and cooling lines

GLOBAL PLUMBING REVIEW

Entire complex

1. Along line 5 - at stairs Fire Dept. Connection at 1st floor impacted.
2. Mostly disconnects and reconnects of water and waste lines during construction impact.

GLOBAL PNEUMATIC TUBE SYSTEM

Entire complex

1. Impact during construction only.

GLOBAL ELECTRICAL REVIEW

Entire complex

1. Localized outlet and conduit disruptions throughout.
2. Localized light fixture disruptions throughout where interior shear walls occur or above ceilings where collectors occur.
3. Telephone terminal cabinet impacted at line 15 and N.
4. Electrical panel, moter controls, and bus risers impacted at line 15 and N.
5. Major conduits and bus risers impacted at line 9 and N.

6. Electrical panel impacted along line N near line 17.
7. Mechanical room B4 (B3) will have starter and control panels impacted. These could impact the equipment operating capabilities.

KC:IMPACTS.doc:lb

CONCEPTUAL COST ESTIMATE

for

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
Oakland, California

Prepared by:
DON TODD ASSOCIATES, INC
303 Second Street, Suite 355
San Francisco, CA 94107

August 5, 1993

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
Oakland, California
CONCEPTUAL ESTIMATE

TABLE OF CONTENTS

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE 8/5/93
6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT
	ESTIMATING ASSUMPTIONS and NOTES:				
1	This is a conceptual estimate for seismic upgrade.				
2	For estimating purposes all work is assumed to be done by outside contractors.				
3	Material prices include all taxes .				
4	All work is assumed to be done during normal business hours.				
5	Removal and relocation of mechanical equipment by others.				
6	This estimate based on notes and sketches provided by P. F. Fratessa associates dated 6/30/93.				
7	The estimate can vary due to changes in scope.				
8	Demolition includes off haul and dump fees.				
9	This estimate is based prior to site visit.				
10	Escalation is included through midpoint of construction. Project duration is 2 years. Assume construction start Jan. 1994, therefore midpoint of construction is Jan. 1995.				
11	Permits and fees are not included.				
12	Architectural, engineering and construction management costs are not included.				
13	Asbestos removal or disposal is not included.				
14	Hazardous material removal or disposal is not included.				
15	Assumed that there is adequate clearance from all equipment to perform require work, per OSHA requirements.				
16	Restoration of Interior finishes includes: framing, gypboard, paint, finishes and accessories.				
17	Assume closure of specified areas of the facility for construction.				
18	Mechanical and Electrical allowances included.				
	EXCLUSIONS:				
1	Removal of furnishing and contents.				
2	Cost for relocating of offices or services.				
3	Construction impact on elevators.				
4	Removal or relocation of stored material in basement.				
5	Cost for relocation of detention facilities.				
6	Cost for disruption to on site parking.				
	NOTES:				
1	**NO SPECIAL COST FOR PHASING.**				
2	**NO PROTECTION COST FOR PEOPLE WORKING IN THE BUILDING.**				
3	**NO TEMPORARY MECHANICAL AND ELECTRICAL COST INCLUDED IN THE ESTIMATE IN CASE THE EXISTING SYSTEMS ARE NOT WORKING DUE TO CONSTRUCTION.**				
4	**NO ARCHITECTURAL CHANGES EXCEPT THOSE AFFECTED BY SHEAR WALLS TO BE REPLACED AS THE ORIGINAL .**				

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE 8/5/93
6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT
	ESTIMATE SUMMARY BY FLOOR - SEISMIC UPGRADE SCOPE				
	ROOF LEVEL				114,895
	9th FLOOR				343,228
	8th FLOOR				289,568
	7th FLOOR				290,693
	6th FLOOR				298,643
	5th FLOOR				423,726
	4th FLOOR				453,734
	3rd FLOOR				440,794
	2nd FLOOR				524,201
	1st FLOOR				529,918
	BASEMENT				381,159
	SUBTOTAL				4,090,559
	GENERAL CONDITIONS, OVERHEAD & PROFIT (17%)				695,395
	PLANNED CONSTRUCTION COSTS				4,785,954
	CONTINGENCY (20%)				957,191
	TOTAL CONSTRUCTION COSTS WITHOUT ESCALATION				5,743,145
	ESCALATION UP TO MIDPOINT OF CONSTRUCTION (4%)				229,726
	TOTAL CONSTRUCTION COSTS				$5,972,871
	ESTIMATED CONSTRUCTION TIME PER FLOOR , TOWER: 10 TO 12 WEEKS				
	ESTIMATED CONSTRUCTION TIME PER FLOOR , COURTHOUSE: 8 TO 9 WEEKS				

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE

8/5/93

6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT
	ESTIMATE SUMMARY BY CSI DIVISION - SEISMIC UPGRADE SCOPE				
DIVISION 1	GENERAL REQUIREMENTS	Included under General Conditions			
DIVISION 2	SITEWORK/DEMOLITION				441,694
DIVISION 3	CONCRETE				2,496,701
DIVISION 4	MASONRY				2,500
DIVISION 5	METALS				250
DIVISION 6	WOODS & PLASTICS				0
DIVISION 7	MOISTURE & THERMAL PROTECTION				101,750
DIVISION 8	DOORS, WINDOWS & GLAZING				78,250
DIVISION 9	FINISHES				530,511
DIVISION 10	SPECIALTIES				0
DIVISION 11	EQUIPMENT				0
DIVISION 12	FURNISHINGS				0
DIVISION 13	SPECIAL CONSTRUCTION				0
DIVISION 14	CONVEYING SYSTEM				0
DIVISION 15	MECHANICAL				317,245
DIVISION 16	ELECTRICAL				121,658
	SUBTOTAL				4,090,559
	GENERAL CONDITIONS, OVERHEAD & PROFIT (17%)				695,395
	PLANNED CONSTRUCTION COSTS				4,785,954
	CONTINGENCY (20%)				957,191
	TOTAL CONSTRUCTION COSTS WITHOUT ESCALATION				5,743,145
	ESCALATION UP TO MIDPOINT OF CONSTRUCTION (4%)				229,726
	TOTAL CONSTRUCTION COSTS				$5,972,871

ESTIMATED CONSTRUCTION TIME PER FLOOR , TOWER: 10 TO 12 WEEKS
ESTIMATED CONSTRUCTION TIME PER FLOOR , COURTHOUSE: 8 TO 9 WEEKS

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE 8/5/93
6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
ROOF LEVEL						
	DIVISION 2					45,285
	Demo and Remove (e) Concr. Beams, Co	2459	CF	15.00	36,885	
	Remove (e) Roofing Material	4800	SF	1.75	8,400	
	DIVISION 3					36,860
	Place 4" Roof Slab	4800	SF	5.50	26,400	
	Rebar	4400	LB	0.90	3,960	
	Drill and Dowel	200	EA	25.00	5,000	
	Grout Patching	1	LS	1,500.00	1,500	
	DIVISION 4					2,500
	Patch (e) CMU	1	LS	2,500.00	2,500	
	DIVISION 5					250
	Rework Accesss Ladders	1	LS	250.00	250	
	DIVISION 7					29,250
	Install (n) Roof Membrane	6500	SF	4.50	29,250	
	DIVISION 8					750
	Reset Roof Drains	1	LS	750.00	750	
	TOTAL - ROOF LEVEL				114,895	114,895
9 th FLOOR						
	DIVISION 2					83,586
	Remove (e) Exterior Ceramic Tiles	1624	SF	2.75	4,466	
	Sandblast Exterior Walls	1800	SF	2.00	3,600	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	2400	SF	3.00	7,200	
	Remove (e) Window Assemblies	200	SF	3.50	700	
	Remove (e) Porcelain Panels	1800	SF	3.75	6,750	
	Erect Scaffolding (all Floors)	1	LS	60,000.00	60,000	
	DIVISION 3					167,168
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Comer Elements	37	CY	375.00	13,875	
	Rebar	6250	LB	0.80	17,760	
	Drill and Dowel	812	EA	25.00	45,400	
	Formwork	270	SFCA	8.50	42,908	
	DIVISION 7					7,500
	Waterproofing (Allowance)	1	LS	7,500.00	7,500	

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE — 8/5/93
6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
9th Floor	**DIVISION 8**					9,000
	Replace Exterior Windows (6'x6')	6	EA	1,500.00	9,000	
	DIVISION 9					41,250
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	200	SF	5.00	1,000	
	New Gypboard Partition	200	LF	35.00	7,000	
	Painting of New Partition	4000	SF	0.85	3,400	
	Exterior Paint	5000	SF	2.00	10,000	
	Exterior Plaster	5000	SF	3.25	16,250	
	DIVISION 15					22,570
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LB	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 9th FLOOR				**343,228**	
8 th FLOOR						
	DIVISION 2					23,586
	Remove (e) Exterior Ceramic Tiles	1624	SF	2.75	4,466	
	Sandblast Exterior Walls	1800	SF	2.00	3,600	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	2400	SF	3.00	7,200	
	Remove (e) Window Assemblies	200	SF	3.50	700	
	Remove (e) Porcelain Panels	1800	SF	3.75	6,750	
	DIVISION 3					167,208
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Corner Elements	37	CY	375.00	13,875	
	Rebar	6250	LB	0.80	17,800	
	Drill and Dowel	812	EA	25.00	45,400	
	Formwork	270	SFCA	8.50	42,908	
	DIVISION 7					7,500
	Waterproofing (Allowance)	1	LS	7,500.00	7,500	
	DIVISION 8					9,600
	Replace Exterior Windows (6'x6')	6	EA	1,500.00	9,000	
	Reinstall E Doors	6	EA	100.00	600	

OAKLAND POLICE ADMINISTRATION BUILDING
SEISMIC UPGRADE
CONCEPTUAL ESTIMATE 8/5/93
6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
8th Floor	**DIVISION 9**					46,950
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	300	SF	5.00	1,500	
	New Gypboard Partition	300	LF	35.00	10,500	
	Painting of New Partition	6000	SF	0.85	5,100	
	Exterior Paint	5000	SF	2.00	10,000	
	Exterior Plaster	5000	SF	3.25	16,250	
	DIVISION 15					22,570
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LBS	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 8th FLOOR				**289,568**	
7th FLOOR						
	DIVISION 2					23,586
	Remove (e) Exterior Ceramic Tiles	1624	SF	2.75	4,466	
	Sandblast Exterior Walls	1800	SF	2.00	3,600	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	2400	SF	3.00	7,200	
	Remove (e) Window Assemblies	200	SF	3.50	700	
	Remove (e) Porcelain Panels	1800	SF	3.75	6,750	
	DIVISION 3					167,833
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Corner Elements	37	CY	375.00	13,875	
	Rebar	6250	LB	0.90	18,425	
	Drill and Dowel	812	EA	25.00	45,400	
	Formwork	270	SFCA	8.50	42,908	
	DIVISION 7					7,500
	Waterproofing (Allowance)	1	LS	7,500.00	7,500	
	DIVISION 8					10,100
	Replace Exterior Windows (6'x6')	5	EA	1,500.00	7,500	
	Replace Exterior Door	1	EA	2,000.00	2,000	
	Reinstall (E) Doors	6	EA	100.00	600	

OAKLAND POLICE ADMINISTRATION BUILDING
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LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
7th Floor	**DIVISION 9**					46,950
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	300	SF	5.00	1,500	
	New Gypboard Partition	300	LF	35.00	10,500	
	Painting of New Partition	6000	SF	0.85	5,100	
	Exterior Paint	5000	SF	2.00	10,000	
	Exterior Plaster	5000	SF	3.25	16,250	
	DIVISION 15					22,570
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LBS	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 7th LEVEL				**290,693**	**290,693**
6th FLOOR	**6th FLOOR**					
	DIVISION 2					24,036
	Remove (e) Exterior Ceramic Tiles	1624	SF	2.75	4,466	
	Sandblast Exterior Walls	1800	SF	2.00	3,600	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	2800	SF	3.00	8,400	
	Remove (e) Window Assemblies	200	SF	3.50	700	
	Remove (e) Porcelain Panels	1520	SF	3.75	5,700	
	Remove (e) Door	6	LS	50.00	300	
	DIVISION 3					176,383
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	14" Shotcrete Wall	12	CY	425.00	5,100	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Corner Elements	37	CY	375.00	13,875	
	Rebar	6250	LB	0.80	19,125	
	Drill and Dowel	812	EA	25.00	48,150	
	Formwork	270	SFCA	8.50	42,908	
	DIVISION 7					7,500
	Waterproofing (Allowance)	1	LS	7,500.00	7,500	

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
6th Floor	**DIVISION 8**					10,100
	Replace Exterior Windows (6'x6')	5	EA	1,500.00	7,500	
	Replace Exterior Door	1	EA	2,000.00	2,000	
	Reionstall (E) Doors	6	EA	100.00	600	
	DIVISION 9					45,900
	Exterior Paint	4800	SF	2.00	9,600	
	Exterior Plaster	4800	SF	3.25	15,600	
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	300	SF	5.00	1,500	
	New Gypboard Partition	300	LF	35.00	10,500	
	Painting of New Partition	6000	SF	0.85	5,100	
	DIVISION 15					22,570
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LBS	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 6th FLOOR				**298,643**	
5th FLOOR						
	DIVISION 2					42,935
	Remove (e) Exterior Ceramic Tiles	2988	SF	2.75	8,217	
	Sandblast Exterior Walls	3164	SF	2.00	6,328	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	6000	SF	3.00	18,000	
	Remove (e) Window Assemblies	1020	SF	3.50	3,570	
	Remove (e) Porcelain Panels	1520	SF	3.75	5,700	
	Remove (e) Door	1	LS	250.00	250	
	DIVISION 3					275,767
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	10" CIP Wall	28	CY	325.00	9,100	
	14" Shotcrete Wall	12	CY	425.00	5,100	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" Shotcrete Exterior Wall	14	CY	425.00	5,950	
	20" Infills, Lines 1 & 6	62	CY	25.00	1,550	
	Rebar	6250	LB	0.80	30,042	
	Drill and Dowel	812	EA	25.00	93,650	
	Formwork	270	SFCA	8.50	69,275	

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LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
5th Floor	DIVISION 7					8,000
	Waterproofing (Allowance)	1	LS	8,000.00	8,000	
	DIVISION 8					10,100
	Replace Exterior Windows (6'x6')	5	EA	1,500.00	7,500	
	Replace Exterior Door	1	EA	2,000.00	2,000	
	Reinstall (E) Doors	6	EA	100.00	600	
	DIVISION 9					52,200
	Exterior Paint	6000	SF	2.00	12,000	
	Exterior Plaster	6000	SF	3.25	19,500	
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	300	SF	5.00	1,500	
	New Gypboard Partition	300	LF	35.00	10,500	
	Painting of New Partition	6000	SF	0.85	5,100	
	DIVISION 15					22,570
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LBS	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 5th FLOOR				423,726	423,726
4th FLOOR						
	DIVISION 2					44,663
	Remove (e) Exterior Ceramic Tiles	2988	SF	2.75	8,217	
	Sandblast Exterior Walls	3164	SF	2.00	6,328	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	6576	SF	3.00	19,728	
	Remove (e) Window Assemblies	1020	SF	3.50	3,570	
	Remove (e) Porcelain Panels	1520	SF	3.75	5,700	
	Remove (e) Door	1	LS	250.00	250	
	DIVISION 3					292,647
	10" Shotcrete Exterior Wall	50	CY	425.00	21,250	
	14" Beams, Lines 5 & 19	3	CY	425.00	1,275	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Collector Beam, Line 5	4	CY	325.00	1,300	
	14" Shotcrete Wall	12	CY	425.00	5,100	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" Shotcrete Exterior Wall	14	CY	425.00	5,950	

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
4th Floor	20" Infills, Lines 1 & 6	62	CY	325.00	20,150	
	10" CIP Wall	28	CY	325.00	9,100	
	Rebar	6250	LB	0.80	32,122	
	Drill and Dowel	812	EA	25.00	86,850	
	Formwork	270	SFCA	8.50	70,975	
	DIVISION 7					**8,000**
	Waterproofing (Allowance)	1	LS	8,000.00	8,000	
	DIVISION 8					**10,100**
	Replace Exterior Windows (6'x6')	5	EA	1,500.00	7,500	
	Replace Exterior Door	1	EA	2,000.00	2,000	
	Reinstall (E) Doors	6	EA	100.00	600	
	DIVISION 9					**63,600**
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	500	SF	5.00	2,500	
	New Gypboard Partition	500	LF	35.00	17,500	
	Painting of New Partition	10000	SF	0.85	8,500	
	Exterior Paint	6000	SF	2.00	12,000	
	Exterior Plaster	6000	SF	3.25	19,500	
	DIVISION 15					**22,570**
	Demolition	500	LF	2.50	1,250	
	HVAC	1720	LBS	10.00	17,200	
	Plumbing	4120	SF	1.00	4,120	
	DIVISION 16					**12,154**
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 4th FLOOR				**453,734**	
3rd FLOOR						
	DIVISION 2					**50,052**
	Remove (e) Exterior Ceramic Tiles	4900	SF	2.75	13,475	
	Sandblast Exterior Walls	5152	SF	2.00	10,304	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	6576	SF	3.00	19,728	
	Remove (e) Window Assemblies	750	SF	3.50	2,625	
	Remove (e) Porcelain Panels	680	SF	3.75	2,550	
	Remove (e) Door	1	LS	500.00	500	

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LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
3rd Floor	DIVISION 3					294,388
	10" Shotcrete Exterior Wall	75	CY	425.00	31,875	
	14" Beams, Lines 5 & 19	5	CY	425.00	2,125	
	CIP Collector Beam, Line 5	4	CY	325.00	1,300	
	14" Shotcrete Wall	12	CY	425.00	5,100	
	14" CIP Wall	76	CY	325.00	24,700	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" Shotcrete Exterior Wall	54	CY	425.00	22,950	
	20" Infills, Lines 1	33	CY	325.00	10,725	
	10" CIP Wall	10	CY	325.00	3,250	
	Rebar	9400	LB	0.80	34,374	
	Drill and Dowel	1216	EA	25.00	86,450	
	Formwork	390	SFCA	8.50	57,664	
	DIVISION 7					8,000
	Waterproofing (Allowance)	1	LS	8,000.00	8,000	
	DIVISION 8					4,600
	Replace Exterior Door	2	EA	2,000.00	4,000	
	Reinstall (E) Doors	6	EA	100.00	600	
	DIVISION 9					52,200
	New Floor Finishes, Vinyl	1200	SF	2.50	3,000	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	1200	SF	0.50	600	
	New Ceiling Finishes	300	SF	5.00	1,500	
	New Gypboard Partition	300	LF	35.00	10,500	
	Painting of New Partition	6000	SF	0.85	5,100	
	Exterior Paint	6000	SF	2.00	12,000	
	Exterior Plaster	6000	SF	3.25	19,500	
	DIVISION 15					19,400
	Demolition	400	LF	2.50	1,000	
	HVAC	1430	LBS	10.00	14,300	
	Plumbing	4100	SF	1.00	4,100	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 3rd FLOOR				440,794	440,794

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
2nd FLOOR						
	DIVISION 2					49,490
	Remove (e) Exterior Ceramic Tiles	3200	SF	2.75	8,800	
	Sandblast Exterior Walls	3500	SF	2.00	7,000	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	8000	SF	3.00	24,000	
	Remove (e) Window Assemblies	1120	SF	3.50	3,920	
	Demo (e) Auditorium	680	SF	5.00	3,400	
	Remove (e) Door	1	LS	1,500.00	1,500	
	DIVISION 3					341,137
	10" Shotcrete Exterior Wall	10	CY	425.00	4,250	
	26" Beams, Lines 5 & 19	14	CY	425.00	5,950	
	CIP Collector Beam, Line 5	4	CY	325.00	1,300	
	20" Infill Wall, Lines 5 & 19	69	CY	325.00	22,425	
	14" CIP Wall	98	CY	325.00	31,850	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" Shotcrete Exterior Wall	54	CY	425.00	22,950	
	20" Infills, Lines 1	33	CY	325.00	10,725	
	10" CIP Wall	10	CY	325.00	3,250	
	Rebar	1500	LB	0.80	39,480	
	Drill and Dowel	118	EA	25.00	96,750	
	Formwork	750	SFCA	8.50	88,332	
	DIVISION 7					8,000
	Waterproofing (Allowance)	1	LS	8,000.00	8,000	
	DIVISION 8					4,400
	Replace Exterior Door	2	EA	2,000.00	4,000	
	Reinstall (E) Door	4	EA	100.00	400	
	DIVISION 9					61,720
	New Floor Finishes, Vinyl	2130	SF	2.50	5,325	
	New Carpet	0	SY	30.00	0	
	Reinstall (E) Ceiling	2130	SF	0.50	1,065	
	New Ceiling Finishes	550	SF	5.00	2,750	
	New Wooden Panel	880	SF	8.00	7,040	
	New Gypboard Partition	270	LF	35.00	9,450	
	Painting of New Partition	5400	SF	0.85	4,590	
	Exterior Paint	6000	SF	2.00	12,000	
	Exterior Plaster	6000	SF	3.25	19,500	
	DIVISION 15					47,300
	Demolition	720	LF	2.50	1,800	
	HVAC	2740	LBS	15.00	41,100	
	Plumbing	4400	SF	1.00	4,400	

OAKLAND POLICE ADMINISTRATION BUILDING
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6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
2nd Floor	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 2nd FLOOR				**524,201**	**1,053,349**
1st FLOOR						
	DIVISION 2					35,270
	Remove (e) Exterior Ceramic Tiles	1120	SF	2.75	3,080	
	Sandblast Exterior Walls	1500	SF	2.00	3,000	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	6500	SF	3.00	19,500	
	Remove (e) Window Assemblies	1120	SF	3.50	3,920	
	Demo (e) Auditorium	680	SF	5.00	3,400	
	Remove (e) Door	1	LS	1,500.00	1,500	
	DIVISION 3					336,044
	10" Shotcrete Exterior Wall	10	CY	425.00	4,250	
	26" Beams, Lines 5 & 19	14	CY	425.00	5,950	
	CIP Collector Beam, Line 5	4	CY	325.00	1,300	
	20" Infill Wall, Lines 5 & 19	69	CY	325.00	22,425	
	14" CIP Wall	98	CY	325.00	31,850	
	10" Shotcrete Wall	28	CY	425.00	11,900	
	20" Infills, Lines 1	33	CY	325.00	10,725	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" CIP Wall	14	CY	325.00	4,550	
	Rebar	1500	LB	0.80	39,680	
	Drill and Dowel	168	EA	25.00	99,600	
	Formwork	750	SFCA	8.50	89,939	
	DIVISION 7					8,000
	Waterproofing (Allowance)	1	LS	8,000.00	8,000	
	DIVISION 8					4,900
	Replace Exterior Door	2	EA	2,000.00	4,000	
	Reinstall Existing Door	9	EA	100.00	900	
	DIVISION 9					80,300
	New Floor Finishes, Vinyl	4120	SF	2.50	10,300	
	New Carpet	30	SY	30.00	900	
	Reinstall (E) Ceiling	4000	SF	0.50	2,000	
	New Ceiling Finishes	120	SF	5.00	600	
	New Wooden Panel	2200	SF	8.00	17,600	
	New Gypboard Partition	400	LF	35.00	14,000	
	Painting of New Partition	4000	SF	0.85	3,400	
	Exterior Paint	6000	SF	2.00	12,000	
	Exterior Plaster	6000	SF	3.25	19,500	

OAKLAND POLICE ADMINISTRATION BUILDING
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6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
1ST FLOOR	DIVISION 15					53,250
	Demolition	720	LF	2.50	1,800	
	HVAC	3020	LB	15.00	45,300	
	Plumbing	4100	SF	1.50	6,150	
	DIVISION 16					12,154
	Power	412	LF	6.00	2,472	
	Lighting	412	LF	16.00	6,592	
	Demo	412	LF	7.50	3,090	
	TOTAL - 1sT FLOOR				529,918	
BASEMENT						
	DIVISION 2					19,205
	Sandblast Walls	1500	SF	2.00	3,000	
	Chip Shear Keyway	116	LF	7.50	870	
	Demo Interior Finishes	3500	SF	3.00	10,500	
	Remove (e) Window Assemblies	1120	SF	3.50	3,920	
	Remove (e) Door	9	EA	75.00	675	
	Remove (E) Vinyl Flooring	600	SF	0.30	180	
	Remove (E) Suspended Ceiling	300	SF	0.20	60	
	DIVISION 3					241,266
	26" Beams, Lines 5 & 19	14	CY	425.00	5,950	
	CIP Collector Beam, Line 5	4	CY	325.00	1,300	
	20" Infill Wall, Lines 5 & 19	69	CY	325.00	22,425	
	14" CIP Wall	98	CY	325.00	31,850	
	CIP Corner Elements	37	CY	375.00	13,875	
	10" Shotcrete Wall	28	CY	425.00	11,900	
	10" CIP Wall	4	CY	325.00	1,300	
	Rebar	2100	LB	0.80	28,160	
	Drill and Dowel	700	EA	25.00	46,000	
	Formwork	200	SFCA	8.50	78,506	
	DIVISION 7					2,500
	Waterproofing (Allowance)	1	LS	2,500.00	2,500	
	DIVISION 8					4,600
	Replace Exterior Door	2	EA	2,000.00	4,000	
	Reinstall (E) doors	6	EA	100.00	600	

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6th STREET INFILL SCHEME

LOCATION	DESCRIPTION	Quantity	Unit	Rate	AMOUNT	
BASEMENT	**DIVISION 9**					38,191
	New Floor Finishes	600	SF	2.50	1,500	
	New Ceiling Finishes	300	SF	3.50	1,050	
	New Gypboard Partition	433	LF	35.00	15,155	
	Painting of New Partition	8660	SF	0.85	7,361	
	Exterior Paint	2500	SF	2.00	5,000	
	Exterior Plaster	2500	SF	3.25	8,125	
	DIVSION 15					61,875
	Demolition	500	LF	2.50	1,250	
	HVAC	3710	LBS	15.00	55,650	
	Plumbing	4150	SF	1.50	6,225	
	DIVISION 16					12,272
	Power	416	LF	6.00	2,496	
	Lighting	416	LF	16.00	6,656	
	Demo	416	LF	7.50	3,120	
	TOTAL - BASEMENT				**381,159**	**379,909**
	TOTAL - ALL FLOORS				**4,090,559**	